Permanent Satisfaction in
YOUR FARM BUILDING

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Permanent Satisfaction in

YOUR FARM BUILDING

CONTAINING CONCRETE
SUGGESTIONS FOR THOSE
INTERESTED IN FARM
IMPROVEMENTS

LEHIGH
CEMENT

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Wednesday evening

Dear Dad:

By the time you get this, I'll be on my way back home. The pictures did it. I've had a longing for the place for months, and when I saw the attractive way you've remodeled the house, I made up my mind to spend the rest of my life where I was raised — on the farm.

I showed the pictures to Charlie Jones and he acted as if he'd like to go back home, too. But his father's farm isn't very inviting for a fellow who likes city comforts, and Charlie has been traveling pretty fast down here in the city.

I noticed you covered the house with stucco. It looks fine and it surely is going to be easier to keep warm, and think of the paint bills you will save! I know Mother will be pleased. That concrete walk will keep mud from being tracked into the kitchen.

I suppose you bought your building supplies from Wiggin. It pays to go to a good dealer like him and get dependable

(over)

materials. I've seen some very poor building here - it looks all right at first but people soon have to start spending money for repairs. There are a lot of unreliable materials on the market.

That's why I say "Stick to Wiggin". He never offers you the "just as good" brand. He has had that Lehigh Cement sign on his store for a long time. That certainly is a dependable material. It's the largest selling brand of cement in the world. When Wiggin carries material like that I say it's a good indication he carries a full line of other dependable materials.

And he always has the latest bulletins and booklets about building, so you can be sure of doing the job right.

If farmers always bought their supplies from reliable dealers who handle well-known dependable materials, they would save a lot of farm profits that now slip away into repair expenses.

I'm packing up today. Give my love to Mother and the rest.

Ed

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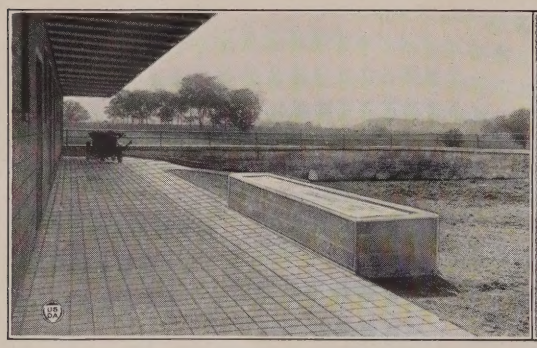


Barnyard pavement and water trough

A concrete feeding floor

The Farm Buildings

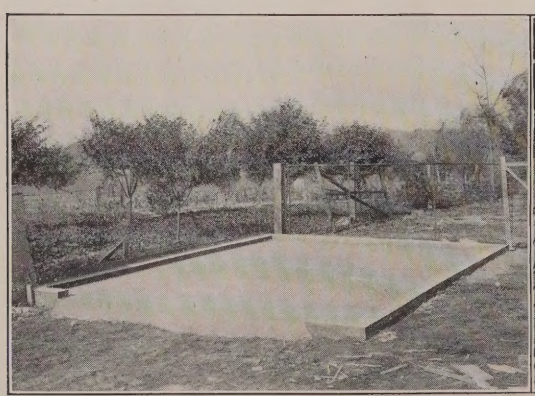
A FARM building is an investment that is intended to produce a profitable return. Well-planned farm buildings are an asset, and the farmstead should be arranged to secure the greatest return possible from the labor expended and the feed consumed.

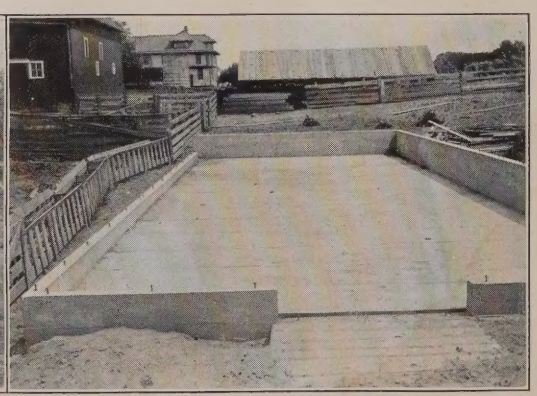
Farm structures should be designed to meet individual needs. No one type of building will suit all requirements or all climatic conditions. The size and arrangement should be decided by a study of the kind of building needed to house the stock comfortably and economically, and to provide room for feed, bedding, tools, and implements. The construction should be such that it will resist the weather without deterioration—it must be permanent. It should be as fire-resisting as possible.

While the farmer often must be his own architect and builder, he should not attempt any large construction without a set of reliable plans. A limited number of working drawings are shown in this book, but it is not possible to give complete details on the larger buildings. If plans are desired on any particular kind of structure, we will be glad to send them on request.

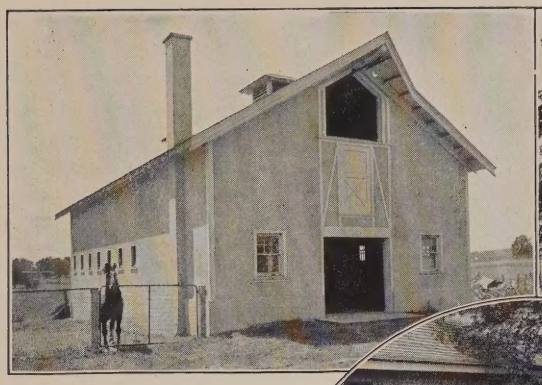
The life of every building will be increased by a strong and permanent foundation. This foundation must be large enough to support the weight of the building without settlement. It must extend below the frost line to prevent damage to the building in freezing weather, and it must go down to firm bearing soil to give the building proper support. If it is to serve as a basement wall as well as a foundation, it must be watertight. Concrete meets every one of these requirements, and in addition it is rat-proof, fire-proof, and economical.

For the walls above grade, monolithic (one-piece) concrete and concrete block are ideal building materials. The purpose of the struc-

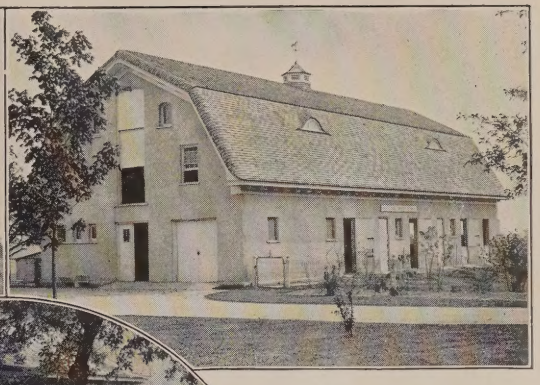




Well-constructed concrete foundations insure permanent satisfaction



A general purpose barn



An attractive sheep barn

A bull pen with a strong concrete wall

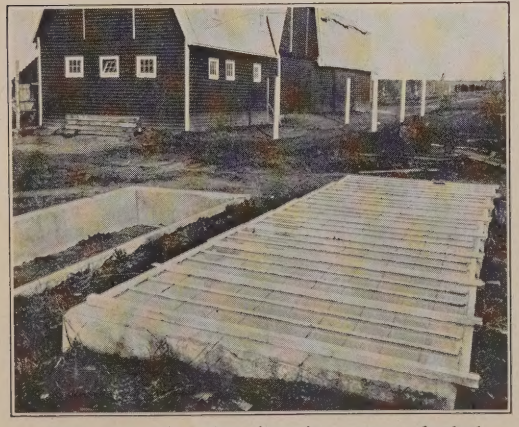
ture will, of course, determine the form of construction that can be used to best advantage. Portland cement stucco for the exterior of farm buildings should not be overlooked. It is both economical and attractive.

A concrete barnyard pavement will greatly improve the appearance of the farmstead, and will prevent the mud hole which so often forms around the barn in wet weather. This pavement will also serve as a feeding floor.

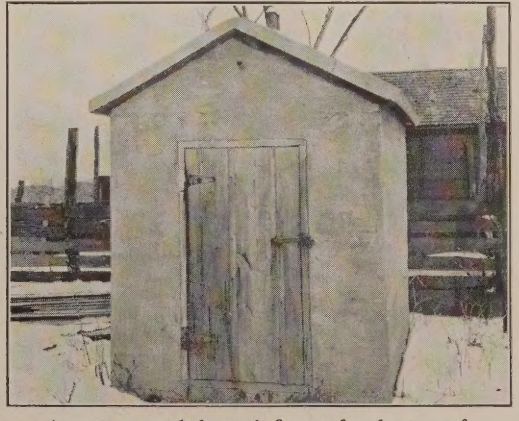
Special concrete block, cast with openings to provide ventilation, are made for the construction of rat-proof corn cribs. This type of crib is usually built circular in form, with a flue at the center connected with air inlets at the base.

Ice houses are subjected to continual dampness, and the rot-proof qualities of concrete provide a building that is not affected by this condition. Concrete block are particularly suited for ice houses, because of the insulation provided by the dead air spaces in the walls.

Concrete staves, which are slabs of concrete 30 inches high, 10 inches wide, and 2½ inches thick, are widely used for silos and circular water troughs and tanks. The staves are held



Start your early spring plants in a concrete hotbed

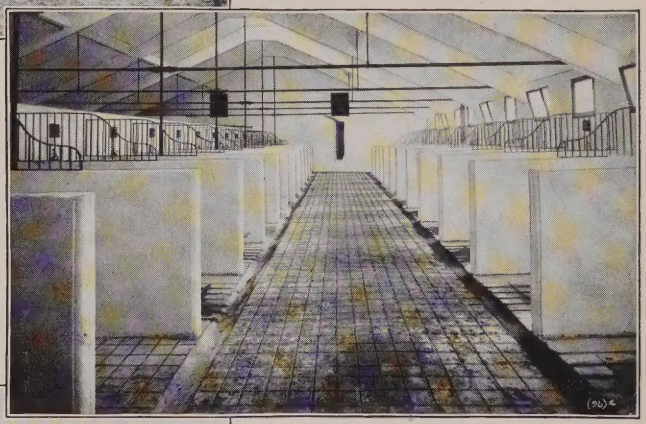


A concrete smokehouse is fireproof and rat-proof

Beef cattle barn

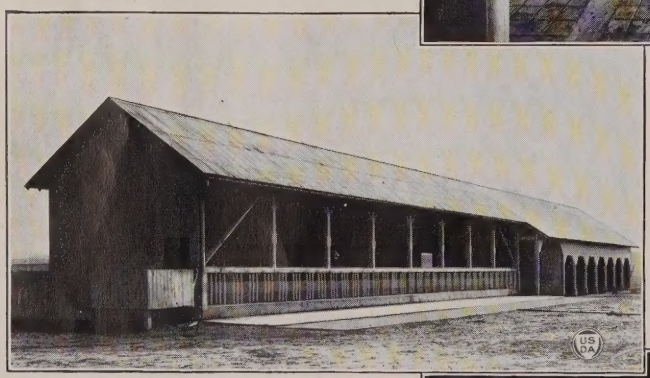
in place by steel hoops. Ease, economy, and speed of construction are important features in favor of concrete staves.

Remodeling an old building does not require a large investment. The foundations and sills of a barn are usually the first to rot because of their contact with the moist soil. A new foundation and side walls of monolithic concrete or of concrete block can readily be placed under an old building. This wall should be carried at least high enough to avoid the drip and splash of rain from the eves, thus avoiding any future necessity of replacement. Floors, horse stalls, and cow stalls of concrete are well worth while in any barn. Rat-proof feed-bins are a paying investment right from the start. A concrete silo will provide feed for the cattle during the winter. An implement shed with a foundation and floor of concrete will save your machinery during the seasons when it is not in use. All these improvements do not have to be completed at one time, but by laying out a program and following it consistently, the farmstead will soon be modern, sanitary, and profitable.

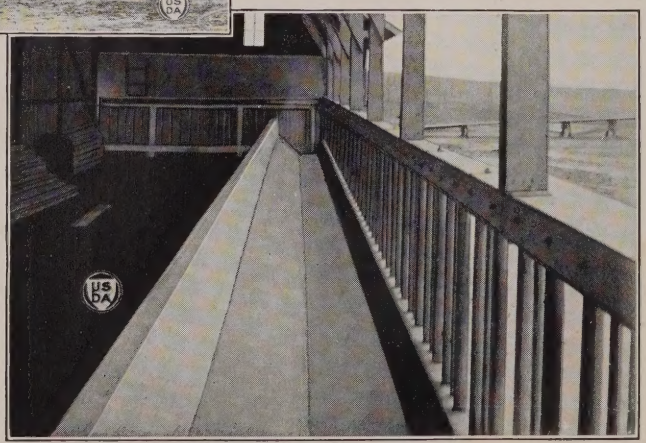


Sanitary horse stable

Concrete is not hard to handle, and if the work is well planned and carefully done, it will never require replacement. Full directions for making concrete are given on pages 38 to 48.



Feed storage shed for beef cattle with concrete platform in front



Interior of feed storage shed, showing manger

Dairy Barns and Milk Houses

THERE is no place where the skill of a dairy farmer is more clearly demonstrated than in the arrangement and planning of his dairy barn. Skill in these matters often determines the difference between profit and loss. Or, to put it another way, whether you struggle for a living, or become known as a man comfortably fixed, may be decided to considerable extent by this very detail.

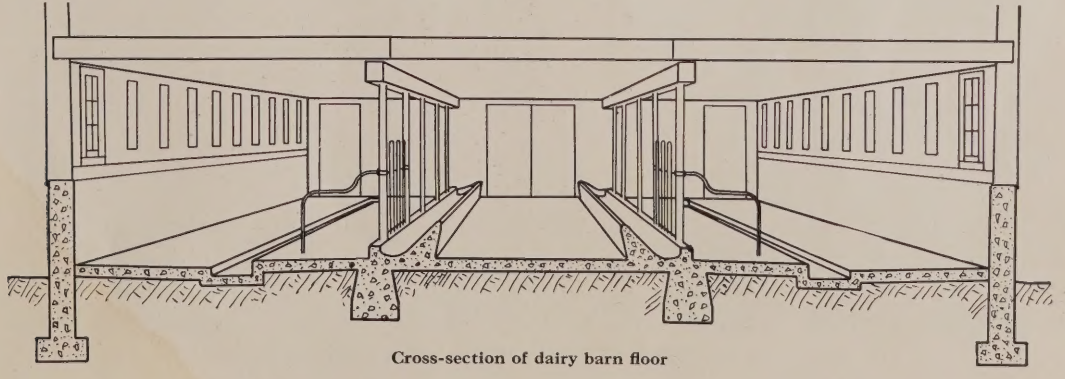
Anything short of absolute cleanliness and sanitation is no longer tolerated by dairy associations, dairy inspectors, and farmers who handle cows at a profit. Low scoring or contaminated milk can be sold only at a loss, and usually results from a condition which a relatively small expenditure will correct.

Nothing is more important in producing sanitary conditions than the use of concrete in dairy barn construction. For foundations, walls, and floors, it has many advantages. It is permanent—once in place, it is there forever. It is durable—none of your well-earned profits need slip away into repairs. It is sanitary—it helps you secure the highest prices for your milk.

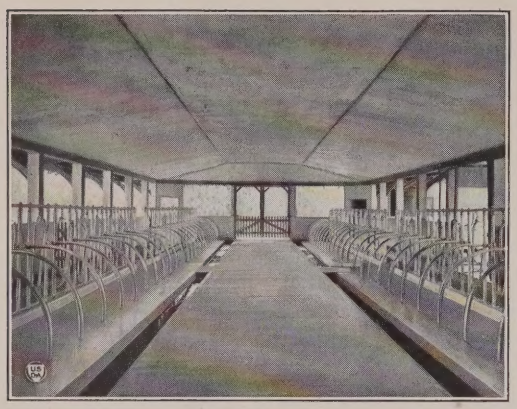
Dairy Barn Floors

It is not at all difficult to put a sanitary concrete floor in either a new or an old dairy barn, with gutters, stalls, and mangers that are designed for durability and cleanliness.

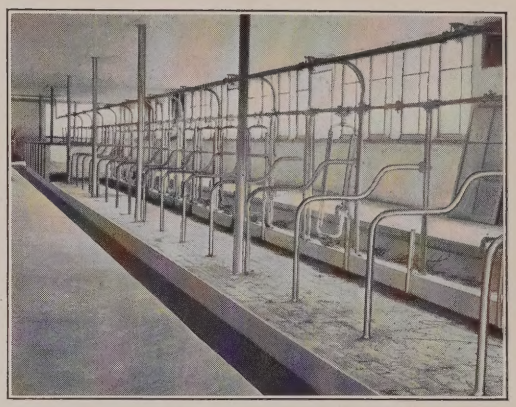
The drawings will show the construction details of a dairy barn floor and a cow stall. The method of constructing this floor will vary according to the equipment used. The upright posts to support the stanchions may be embedded in the curb; or they may be fastened by means of anchors placed when pouring the curb; or they may be clamped over the curb. The stall partitions may also be set in place before or after the concrete is



Cross-section of dairy barn floor



A southern dairy barn, open at the sides



A northern barn, equally well lighted

laid. In the latter case, holes about six inches in diameter must be provided, and after the partitions are placed, the holes can be filled with concrete. It is advisable to form a cone of concrete wherever metal joins concrete, to drain away all moisture and protect the metal from rust.

The length of the stall from the curb to the gutter will vary from 4 feet 6 inches to 4 feet 10 inches, depending on the breed of cattle. Cows of any given breed are fairly uniform in length, and any slight variation from the average can be provided for by means of stanchion adjustments, or by building the standing platform longer at one end of the row and shorter at the other end. This will provide different stall lengths for different size cows.

A 1:2½:4 concrete mixture (1 part cement, 2½ parts sand, and 4 parts gravel or stone) is recommended for dairy barn floors. Good, clean sand and gravel or stone should be used; all the materials should be thoroughly mixed, and the smallest amount of water necessary to make a workable mixture should be used.

In order to secure a surface that is never slippery, even when wet, dairy barn floors should be finished by smoothing with a wooden trowel, or float, which will produce a slightly roughened surface.

After placing the floor, allow it to cure and harden thoroughly before it is used. At least ten days should be allowed, and during this time the floor should be covered with straw or earth and kept wet. The future strength and wearing qualities of the concrete will be greatly increased by this method.

Sanitary Milk Houses

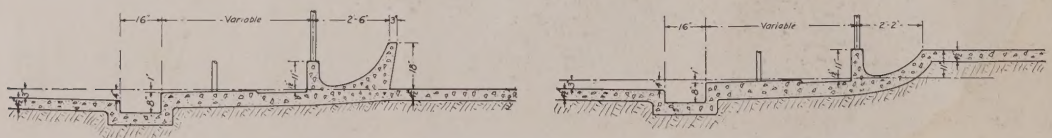
Milk just drawn, even when produced under the best of conditions, always contains a few bacteria. If it is not quickly and effectively cooled, these bacteria soon multiply into thousands. Often they cause fermentation before the milk reaches the receiving station.

Milk should not be handled in the kitchen, wash-room, or workshop. It should be removed to the dairy house as soon as drawn, and cooled within an hour to as near 60° as possible. With a properly constructed milk house, milk can be cooled to within three or four degrees of the temperature of the available spring water.

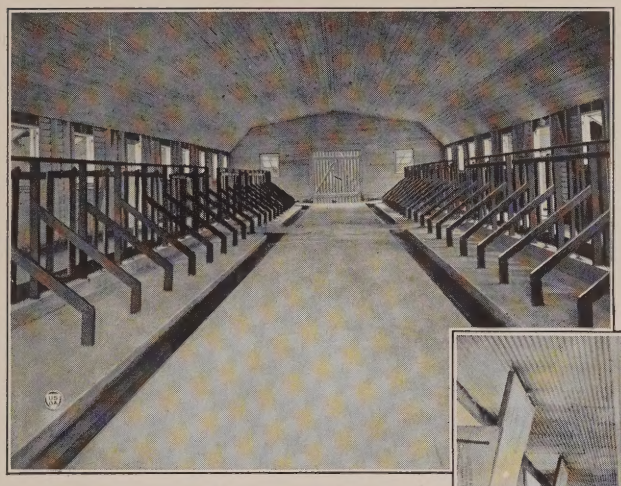
A concrete milk house with a fireproof roof is durable and sanitary. It will never rot away, no matter how wet it becomes, and as it requires no repairs or repainting, it will keep on rolling up profits without expense.

Details for Constructing a Milk House that will Assure Permanent Satisfaction

After carefully marking out the foundation, excavate the trench so that the sides are even



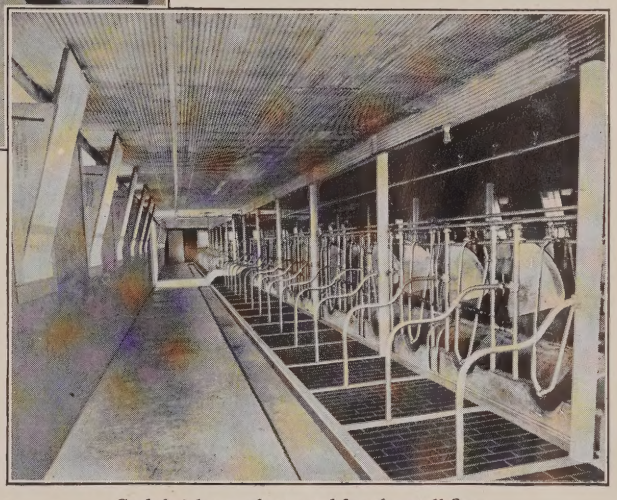
Details for concrete stalls, showing two types of mangers and feed alleys



A dairy barn with wooden stanchions

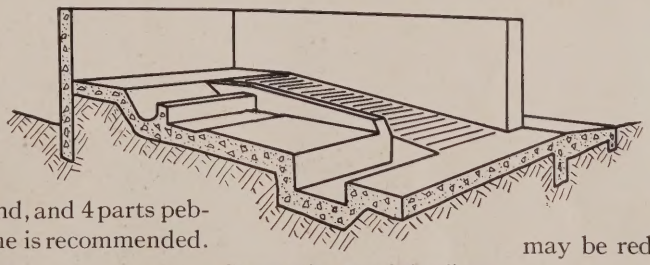
The next step is to build the milk cooling tank, which is placed against the rear wall and so constructed that 12 inches is above the floor level and the balance below. The tank should be just deep enough so that the water will reach the neck of the cans. A device for holding the cans down when partially filled is illustrated.

When milk is cooled by well or spring water, a minimum inside width of 24 inches is recommended, but in case iced water is used, this width may be reduced to 19 inches.

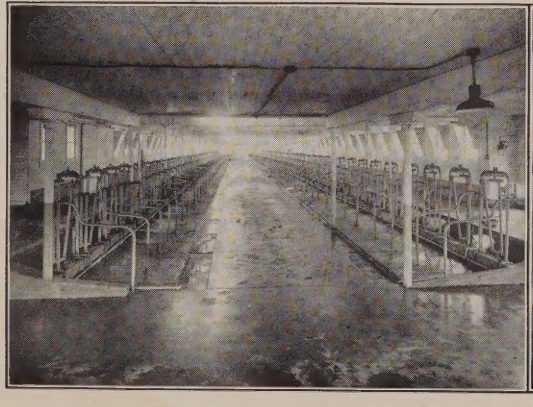


Cork brick are often used for the stall floor

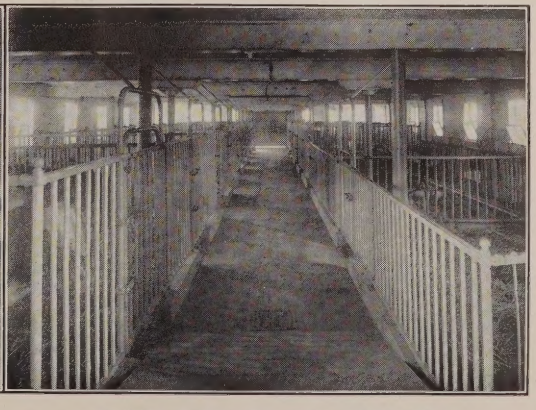
and vertical. If the earth walls of the trench are firm, forms will not be necessary for that part of the foundation wall below grade. If the soil is not firm, additional excavation will be necessary to permit the construction of forms. The foundation should be carried below the usual frost line to prevent upheaval by freezing. For the wall above grade, forms should be made with 1 by 6-inch boards, well braced. Concrete mixed in the proportion of 1 part cement, 2½ parts sand, and 4 parts pebbles or broken stone is recommended.



Cross-section at end of stall row

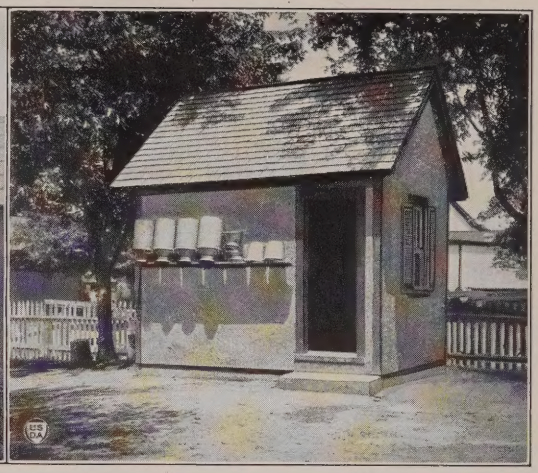


Concrete floors are easily cleaned with a hose



Individual pens of concrete and metal

A monolithic concrete milk house



A concrete stucco milk house

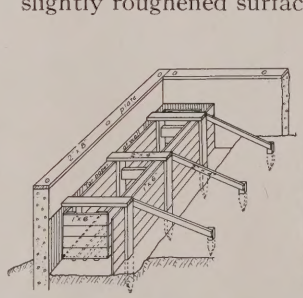
For cooling by well or spring water, a uniform flow is secured by placing the inlet at one end, at the tank floor level, and the outlet or overflow pipe at the opposite end, as shown on the drawing. The grooves in the tank floor permit water to circulate under the cans freely, resulting in more rapid cooling of the milk. Strips are attached to the bottom of the inside form to shape these grooves.

Tank floor and sides are concreted in one operation, the floor of the tank being made six inches thick and the sides four inches.

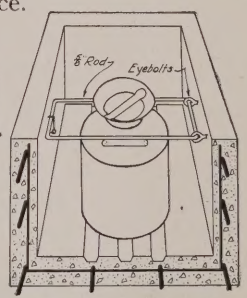
Reinforcement consists of 3/8-inch rods spaced 12 inches apart, as indicated in the drawing. The reinforcement of the floor and sides is made continuous by bending the rods "U" shaped. Rods are also extended around the tank sides, with ends lapped at least 12 inches. At all intersections reinforcing rods are firmly wired together, to hold them in correct position. They should be suspended the proper distance from the bottom by wiring securely to the top cross-braces. The inside form is also suspended from the top cross-braces.

For the tank a 1:2:3 mixture (one part cement, two parts sand, and three parts of gravel or stone) is recommended. Screened gravel or crushed stone up to one inch in size can be used.

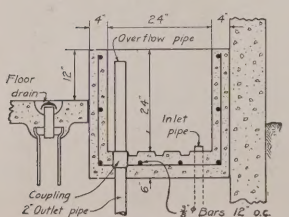
The floor of a milk house should rest on firm soil. It should be made of a 1:2:3 concrete mixture, with stone or gravel not larger than 1½ inches. The full 5-inch thickness of concrete should be placed in one operation and thoroughly packed. Finish by smoothing with a wooden trowel or float, which will give a slightly roughened surface.



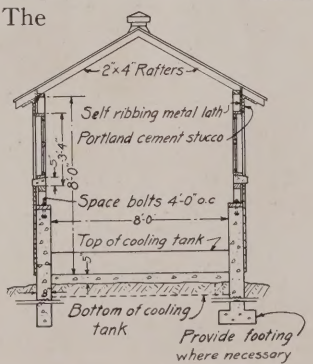
Forms for tank



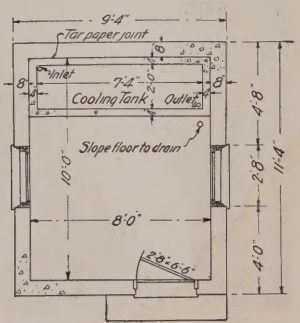
Cross-section of tank



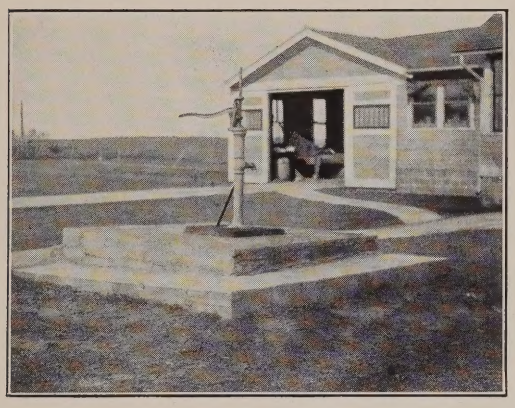
Cross-section of tank

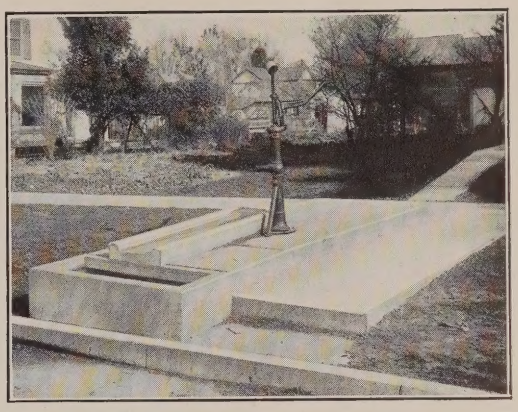


Cross-section of milk house



Plan of milk house





Safeguarding health with concrete well covers

Well Covers and Cisterns

A CONCRETE well lining and cover will permanently insure the water supply against contamination by surface drainage. Where a well is the source of a domestic water supply, this simple safeguard to health should not be neglected.

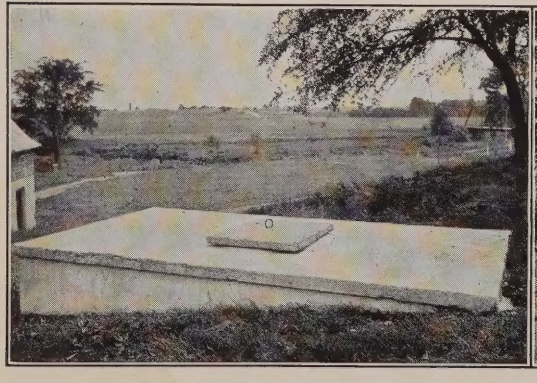
A concrete well lining should extend into the well to a depth of six to eight feet below the ground level, or to a sufficient depth to stop seepage of surface water, and to prevent animals from burrowing beneath it. When building a new well, it is desirable to line it with concrete from bottom to top. A well lining for an ordinary sized well should be at least 5 inches thick.

A 1:2:3 mix (one part cement, two parts sand, and three parts of gravel or stone) is best for well linings, as a watertight wall is necessary to prevent pollution from outside sources. A 1:2:4 mix is recommended for the cover slabs when reinforcing rods are used.

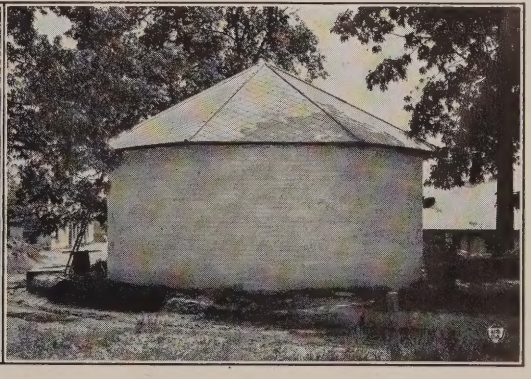
Cistern

A dependable water supply is a valuable asset on a farm, particularly when it is under pressure and can be piped to the house and barn. Both labor and time are saved, and protection against fire is always at hand. A concrete cistern or tank is ideal for the storage of water. It is absolutely sanitary, and it is permanent. It will not rot nor rust, even though placed under ground.

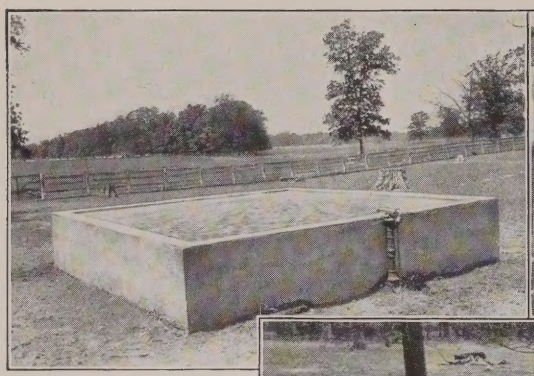
If the source of the water supply is above the house and farm buildings, a gravity water system is easily installed by locating the cistern on the higher ground. Otherwise it will be necessary to build the tank on one of the highest farm structures and to raise the water with a pump.



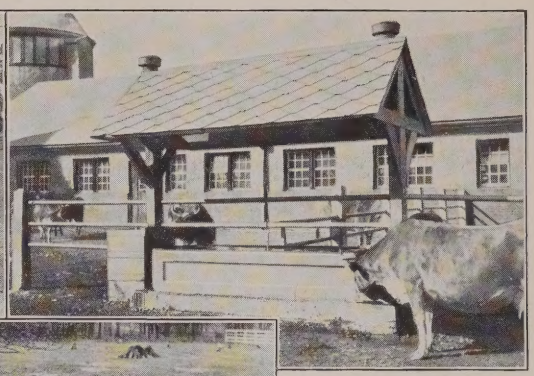
Concrete cistern partly under ground



Concrete tank for water storage



An abundant supply of clean water is an asset to any farm



Concrete water troughs are necessary on all farms where stock is kept

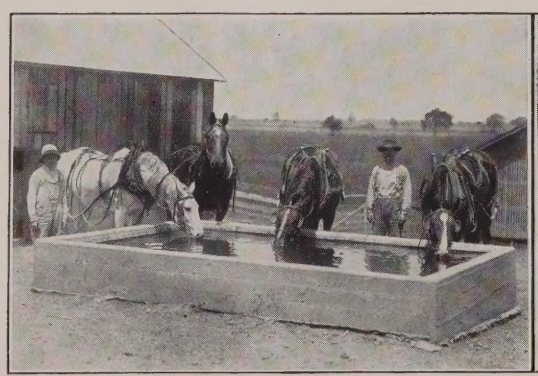
Water Troughs

PERMANENCE and sanitation are the most important advantages of a concrete water trough. Watertightness is an essential, and as it is easier to make concrete watertight at the time of construction than it is to repair it afterward, the work should be carefully done.

The drawing on the following page shows the forms and details of construction. A 1:2:3 concrete mixture (one part cement, two parts sand, and three parts gravel or stone) is recommended. The entire job should be poured in one operation, making the tank monolithic (one-piece) throughout, and eliminating the possibility of leaky seams.

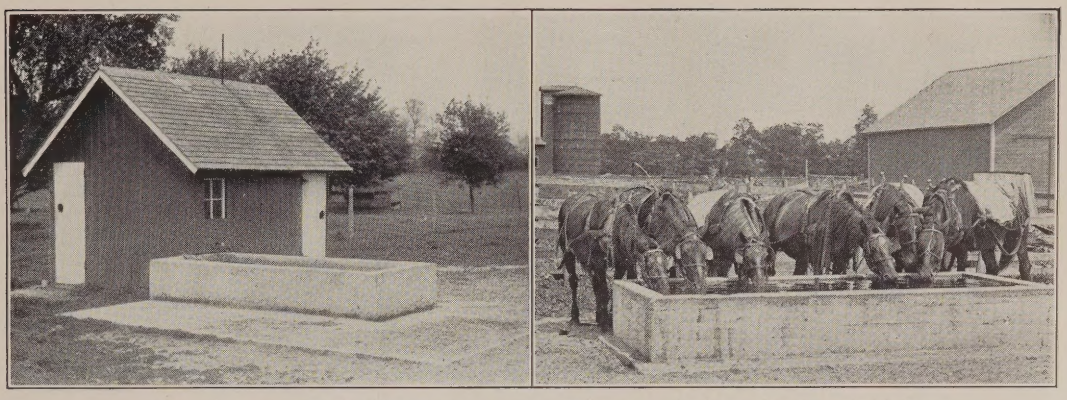
The pressure exerted by the water makes reinforcement necessary. This should consist of $\frac{5}{8}$-inch rods spaced 12 inches apart. The reinforcement for the floor and sides should be made continuous by bending the rods U-shaped. Rods are also extended around the tank corners, and the ends lapped 12 inches. Reinforcement rods should be firmly wired together wherever they cross. The entire reinforcement, now in the form of a basket, should be suspended from the cross-braces with wires.

The concrete should be mixed as dry as possible and poured in layers of about six inches. It should be well compacted to obtain a dense



A handy trough near the barn

A popular water hole

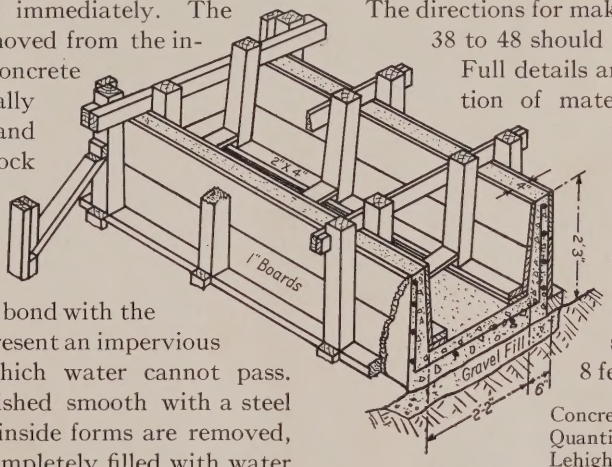


A paved area surrounding the watering trough will prevent the formation of a mud hole

mass and to insure a close bond with the reinforcing steel.

The floor of the trough should be finished with a steel trowel immediately. The forms should be removed from the inside as soon as the concrete is hard enough, usually within 24 hours, and any air holes or rock pockets filled and troweled smooth. A thin plaster coat of 1:2 mortar will make a good bond with the wall concrete, and present an impervious surface, through which water cannot pass. This should be finished smooth with a steel trowel. After the inside forms are removed, the tank can be completely filled with water to retard the drying and enable the concrete to harden slowly.

The outside forms should not be removed for a week. The appearance of the tank can be improved by rubbing the walls with an abrasive stone as soon as the forms are removed, to remove the marks of the wooden forms.

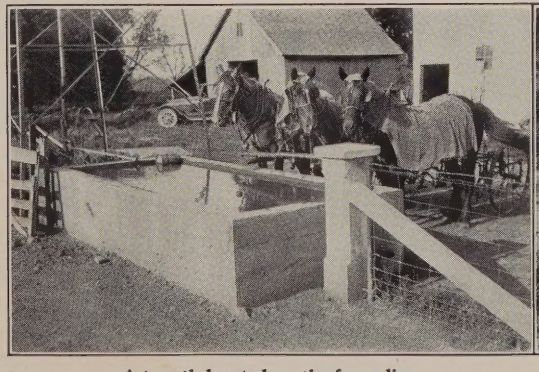


The directions for making concrete on pages 38 to 48 should be carefully followed. Full details are given on the selection of materials, the making of forms, how to use reinforcing, and how to place the concrete so as to obtain a dense and watertight mass.

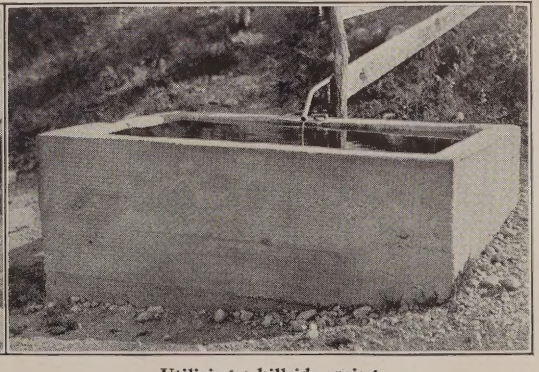
The materials required for a trough as shown in the drawing, 8 feet long, are as follows:

Concrete Mixture, 1:2:3
Quantity of Concrete .24 cu. ft.
Lehigh Cement .....6 sacks
Sand, ¼ inch and under.....½ cu. yd.
Stone, ¼ inch to 1 inch.....⅔ cu. yd.

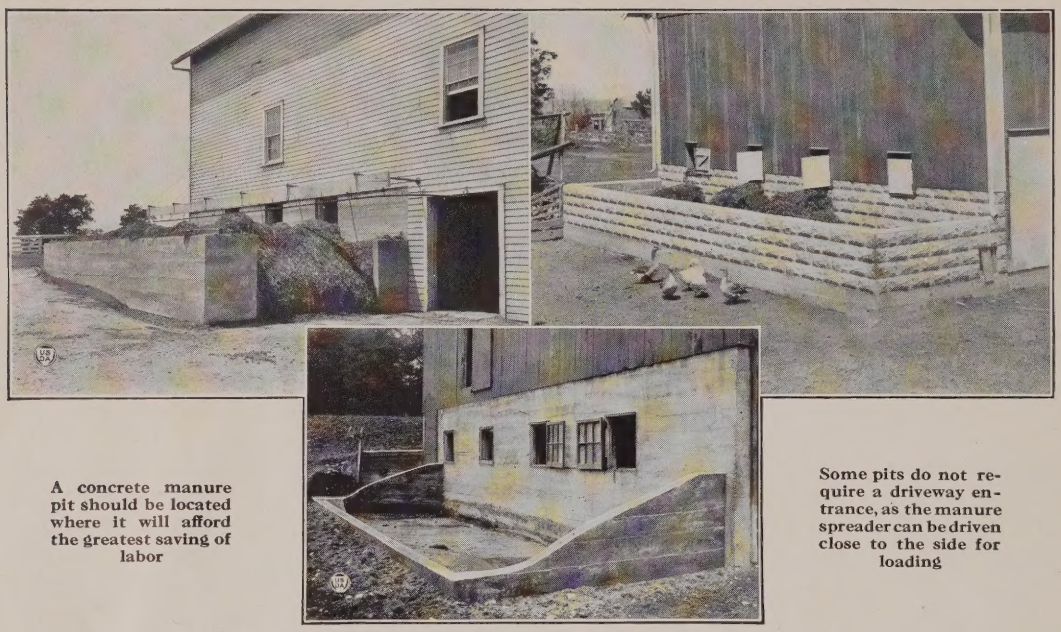
Reinforcing:
⅝ inch rods 7 ft. 6 in. long.....10 pieces
⅝ inch rods 6 ft. 2 in. long..... 8 pieces



A trough located on the fence line



Utilizing a hillside spring



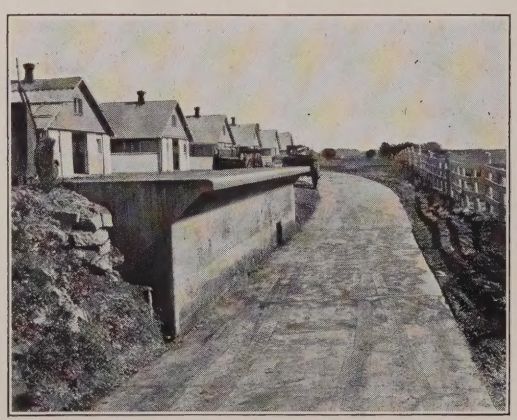
A concrete manure pit should be located where it will afford the greatest saving of labor

Some pits do not require a driveway entrance, as the manure spreader can be driven close to the side for loading

Manure Pits

MANURE is one of the most valuable by-products of your farm, and offers you a ready and inexpensive means of increasing your profits through greater crop production. Manure supplies the soil with all elements of plant food, especially nitrogen and potash. Its value to you depends upon how much of these elements are preserved and eventually spread over the fields of your farm. If the manure is not carefully handled, much of the nitrates and potash can easily be lost and the value of the manure greatly reduced.

Manure undergoes loss by rotting, by seeping into the soil or leaching, and by failure to conserve the liquid manure. This loss can be very large—half of the organic matter, half of the nitrogen, half of the potash can be washed into the nearest stream. On a moderate sized stock farm the loss can easily amount to hundreds of dollars a year.



A concrete loading platform for manure

Save your manure! Don't lose this money! Preserve all the valuable fertilizing elements in a concrete pit that quickly repays its cost of construction and then goes on year after year adding to your profits. The old way of handling manure by dumping it into a corner of the barnyard is behind the times.

Also it is wasteful, and unsanitary, and you have learned how easy it is to lose profits through poor sanitation.

A manure pit should be located where it will afford the greatest saving of labor. A small shallow concrete enclosure can often be placed along the side of the horse stable. This type of pit does not require a driveway entrance, as the manure spreader can be driven close to the pit for loading. The dairy authorities recommend that on all dairy farms the old practice of placing the manure pit next to the barn be discontinued. A separate

manure pit overcomes the possibility of the herd tracking through the manure.

The necessity for a shed depends upon the nature of the manure. A shed is a necessity over a pit which is to hold cow or pig manure. This manure already holds nearly all the moisture possible, and is kept in best condition when protected from the rain.

Manure from horses, sheep, and poultry is relatively dry and porous. It undergoes rapid decomposition, and quickly develops a high temperature, which will give off nitrogen, causing a heavy loss. An uncovered pit with a tight floor will be found satisfactory for storing this kind of manure, as an average rainfall will offset the loss of moisture by evaporation.

Construction Details

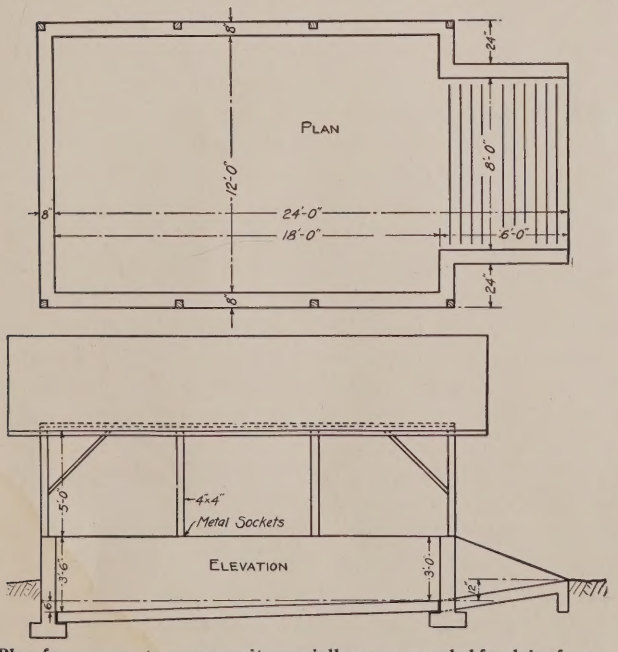
In the construction of a manure pit the foundations and walls are built first. It is usually true that the foundation footings are necessary and they make an excellent base upon which the wall forms may be built. The wall forms should not be removed for at least three days. The longer they can be left on the better the concrete will cure. Back filling of earth should never be started before the concrete is a week old, and it is much better to wait until the floor has been placed.

Before laying the concrete floor the sub-grade of earth should be well packed to eliminate any possibility of soft spots developing, and if the soil is of a water-holding nature, such as clay, it will probably be advisable to install around the edge of the floor a line of drain tile, and place a thin layer of cinders or gravel underneath the floor itself. This will eliminate the possibility of the floor heaving and cracking due to interior and exterior moisture in the winter. When laying the floor, the bottom should be level with the top of the foundation footing, and there should be a ⅜-inch asphalt or tar expansion joint placed between the wall and the floor. Construction of this sort will provide an excellent watertight foundation for the floor at its edges, where it would be most apt to sink.

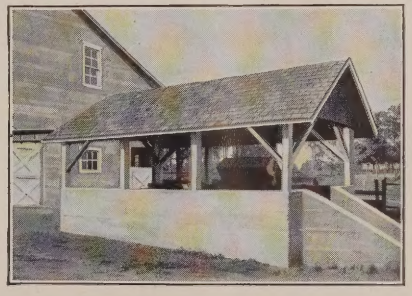
The concrete should be mixed in the proportion of 1:2½:4, being 1 part of cement, 2½ parts of sand, and 4 parts of stone or gravel graded in size from ¼ inch to 1½ inches. The floor should be cured for at least a week by covering it with straw and keeping it moist, to enable it to harden slowly.

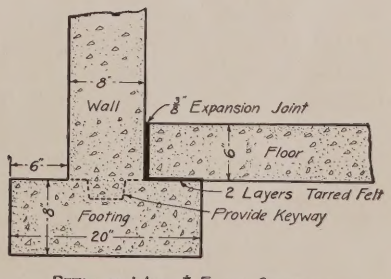
The materials required for a manure pit 12 feet by 18 feet, as shown in the drawing, are as follows:

Concrete Mixture, 1:2½:4	
Quantity of Concrete	356 cu. ft.
Lehigh Cement	71 sacks
Sand, ¼ inch and under	6⅞ cu. yds.
Stone, ¼ inch to 1½ inches	10⅘ cu. yds.

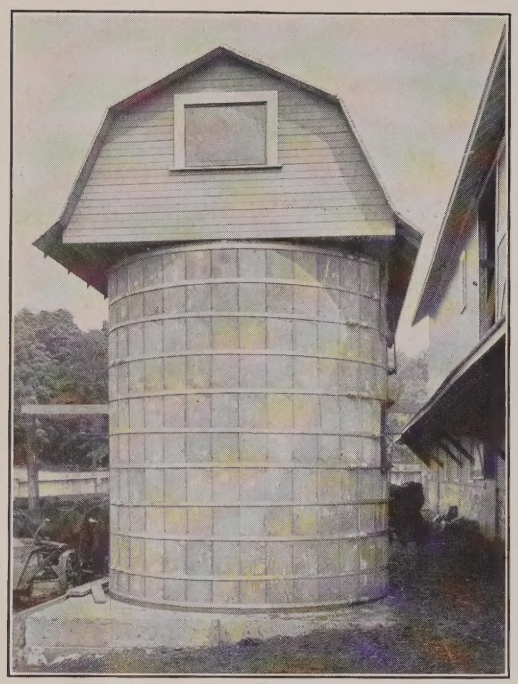


Plan for a concrete manure pit especially recommended for dairy farms

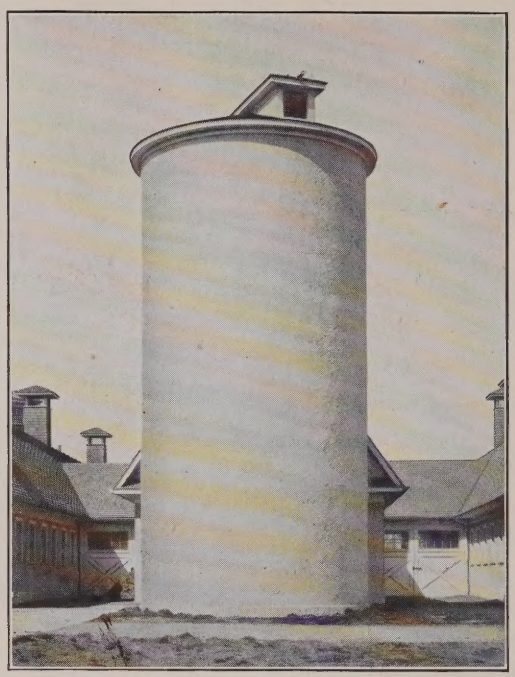




DETAIL OF WALL & FLOOR CONNECTION



A concrete stave silo



A monolithic (one piece) silo

Concrete Silos

SILOS must be air-tight, watertight, strong, durable, and have smooth interior walls. They must be permanent and require little or no maintenance. If the proper method of construction has been followed, the silo will be fireproof. No quality is more desirable than fireproofness when it is considered that the silo usually contains a season's crop of feed.

The silo should be located where it will serve the greatest convenience in feeding operations, and is usually connected to the barn by a short covered passageway.

Monolithic Construction

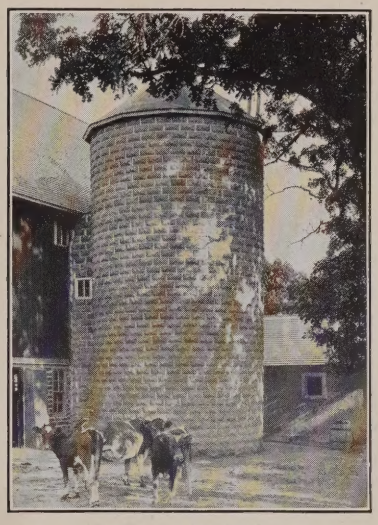
Silos may be made of monolithic concrete, concrete blocks, or concrete staves. For monolithic construction, special circular steel forms should be secured, because the cost for material and labor for making wood forms is seldom justified for a single structure. It is usually better to engage an experienced contractor who specializes in the building of silos to move his outfit to the farm and put up the structure.

In building monolithic silos only one complete ring per day can be cast on the structure. Under favorable conditions the concrete will have hardened sufficiently during a period of twenty-four hours to permit raising forms for the next day's concreting. This procedure is carried on until the structure is completed. In cold weather concrete does not harden rapidly, and forms should not be raised at the end of twenty-four hours unless the concrete has hardened sufficiently. Frozen concrete should not be mistaken for naturally hardened concrete.

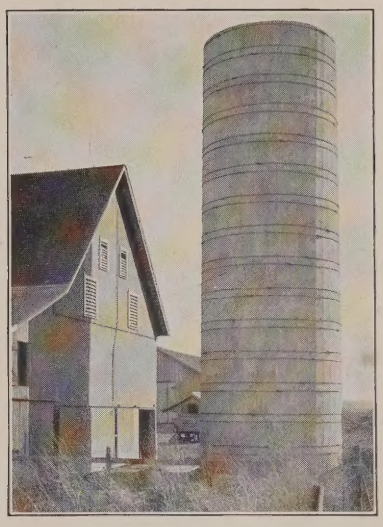
The exterior of the silo can, if desired, be given a uniformly even appearance by applying a coat of cement and water paint after concreting has been completed. This can also be applied to the interior wall face, and will aid in sealing the pores and irregularities in the surface.

Fireproofness is not secured in the fullest measure unless the structure is finished with a concrete roof.

When a silo has been filled with silage, the contents subject the walls to considerable pressure. This pressure is greatest at the bottom, particularly when there is considerable liquid in the silage. Therefore, more reinforcement must be used in the lower portion of the structure than nearer the top. Vertical reinforce-



A concrete block silo



A concrete stave silo

ment also is needed in all monolithic silos. This usually consists of ⅜- or ½-inch steel rods spaced 30 inches apart along a line corresponding to the center of the silo wall.

Block Silos

Concrete block silos are built of block molded in a special machine which gives them a slightly curved face. When laid in courses, they produce a circular structure.

A concrete block silo is essentially a masonry job, and it involves, among other things, well-bedded mortar joints in order that the finished structure shall have the required watertightness and leak-proof qualities necessary. It is, therefore, better to engage a local contractor to do the work.

Block silos must be reinforced. Horizontal hoops in the form of round rods can be embedded partly in the mortar joints and partly in grooves cast when the block is made.

Intermittent doors with concrete doorframes are generally preferred for block silos. The interior of the block silo may be given a coat of cement plaster, similar to that used on the monolithic silo.

Stave Silos

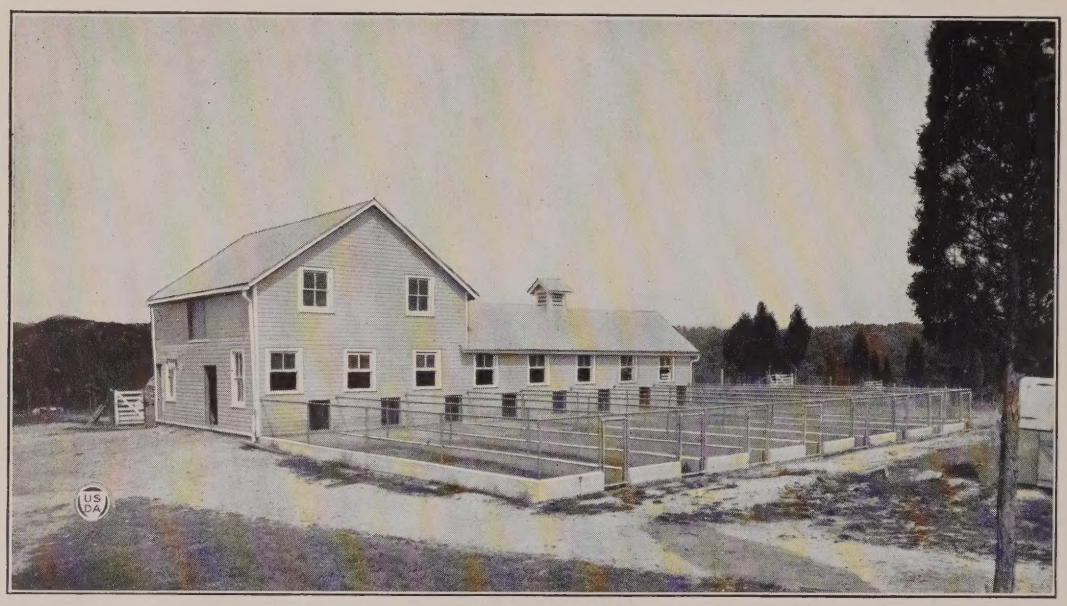
The concrete stave silo is also very popular. A concrete stave is a slab of concrete, generally from 2½ to 3 inches thick, 10 to 12 inches wide, and from 28 to 30 inches high. When used to lay up the wall, the staves are set on end and their edges interlock. An advantage of the concrete stave silo is the fact that it can be very quickly erected.

The concrete stave silo, like the block and monolithic structure, is wind-proof, rot-proof, and fireproof, and possesses a degree of permanence found only in concrete construction. The principal difference between concrete stave silos and the other types of concrete silos lies in the manner in which reinforcement is applied. In the monolithic silo reinforcement is embedded in the concrete. In the block silo the reinforcement is placed between the block and embedded in the mortar, while in the concrete stave silo it takes the form of hoops placed on the outside and tightened by means of turnbuckles.

As in the case of monolithic and block silos, it is recommended that an experienced contractor be engaged to erect a concrete stave silo.

APPROXIMATE CAPACITY OF ROUND SILOS

Height of Silo, Feet	Inside Diameter of Silo in Feet and Capacity in Tons					
	10 Feet	12 Feet	14 Feet	16 Feet	18 Feet	20 Feet
	Tons	Tons	Tons	Tons	Tons	Tons
28	42	61	83	..	..	..
30	47	67	91	..	..	..
32	51	74	100	131	..	..
34	56	80	109	143	..	..
36	61	87	118	155	196	..
38	66	94	128	167	212	..
40	70	101	138	180	229	280
42	..	109	148	193	244	299
44	..	117	159	207	261	320
46	..	..	170	222	277	340
48	..	..	..	236	293	361
50	..	..	..	..	310	382



A well-planned hog house with concrete yards

Hog Raising

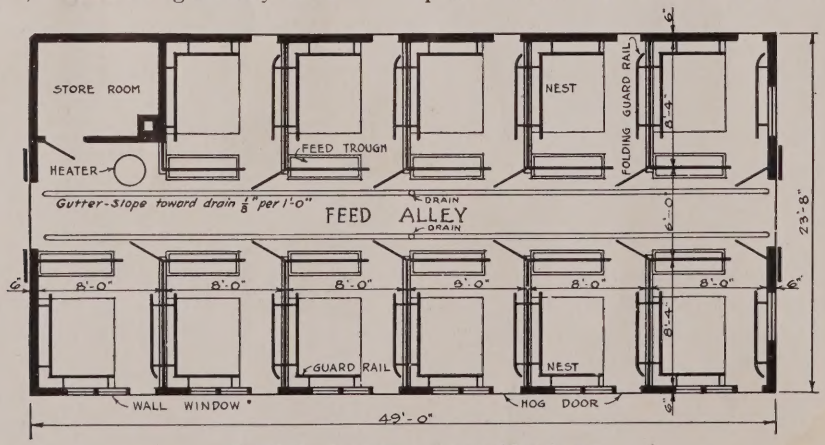
MODERN, well-built hog houses are proving their value as profitable investments. Hogs well cared for are more profitable than those raised in straw stacks and other makeshift shelter. Warm and sanitary houses are a necessity for the successful raising of early pigs.

Sunshine is essential in a hog house. It promotes sanitation, warmth, and dryness. It should reach every part of the house, particularly the beds and floors. The superstructure of a hog house will vary according to the particular requirements of the builder. For the floor, concrete is generally used.

Floor plans are practically standardized, and concrete is used to meet the requirements of sanitation and durability. To further insure warmth and absolute dryness, a nest or bed is sometimes placed in each pen. This nest can be made of cork brick, wood blocks, or planking.

The floor of the pens should slope from the side walls to the gutters along the alleyway. The alleyway floor should be slightly crowned.

The pens are usually arranged in a row on each side of the building, with the feed alley in the middle. The nest in each individual pen is located in the corner next to the wall,



Detail showing layout of typical hog house

and the concrete feed trough is parallel with the alley. A hog house laid out in this manner is convenient and will save a great deal of labor in caring for the stock.

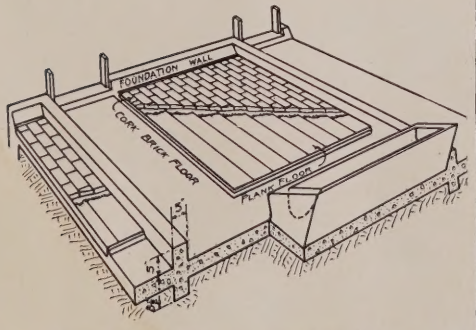
A 1:2½:4 mix of concrete (1 part cement, 2½ parts sand, and 4 parts gravel or stone) is recommended for the floor of a hog house. One course construction is best, the entire thickness of concrete being placed in one operation.

Feeding Floors

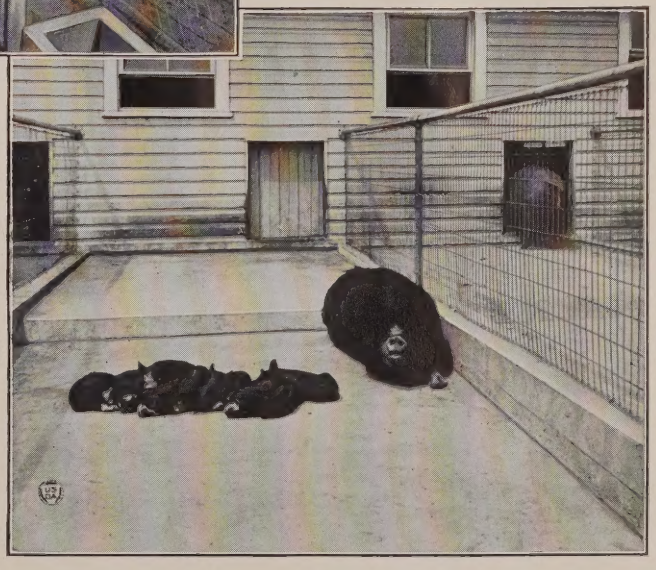
A feeding floor for hogs provides a dry and easily cleaned surface, and prevents the loss of feed which might otherwise be tramped into the mud. The floor should have a rim of sufficient height to prevent the feed from being pushed off and wasted. The foundation wall at the sides should extend into the ground at least 12 inches, otherwise the hogs will undermine the floor by rooting beneath it.

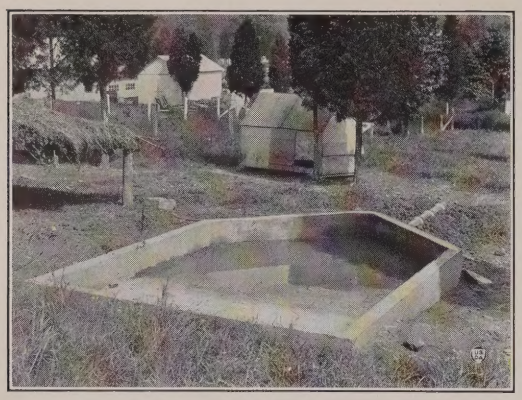
With a concrete yard and wallow such as is illustrated here the hogs can be kept clean with a minimum of labor

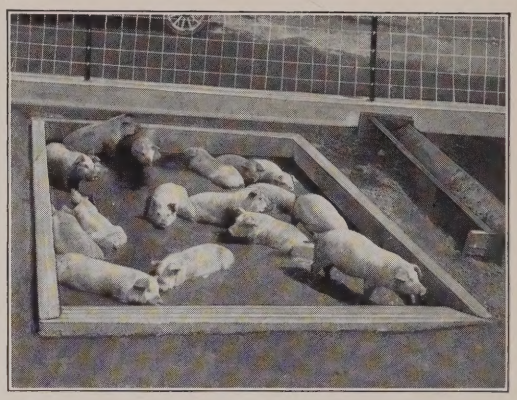
Concrete floors properly sloped to drain to the gutter should be used throughout a hog house. Feed troughs of concrete are easily built at the time the floor is laid



Construction details of a concrete hog pen, showing floor, foundation, and feed trough. If desired, a nest can be constructed of cork brick, wood block, or boards







Details for these hog wallows are shown in the plans below

A 1:2½:4 mix of concrete should be used for a feeding floor. A thickness of 5 inches or more is best. To retard the drying of newly laid concrete, cover the floor with straw and keep wet for at least five days.

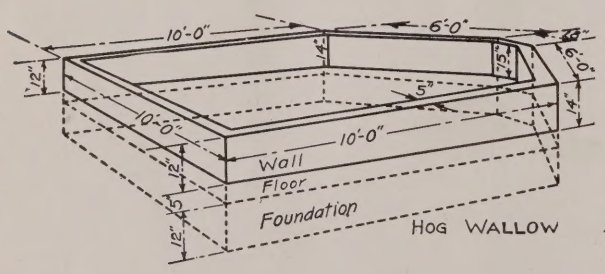
Hog Wallows

A concrete hog wallow will assist in keeping pigs clean and free from mange and insect pests. Unless a wallow is provided, the hogs will quickly make a disease-breeding mud hole somewhere on the hog lot.

A concrete hog wallow is easily made. The size and shape will vary according to individual needs. A drain outlet is always desirable, and an overflow pipe is necessary if running water is used.

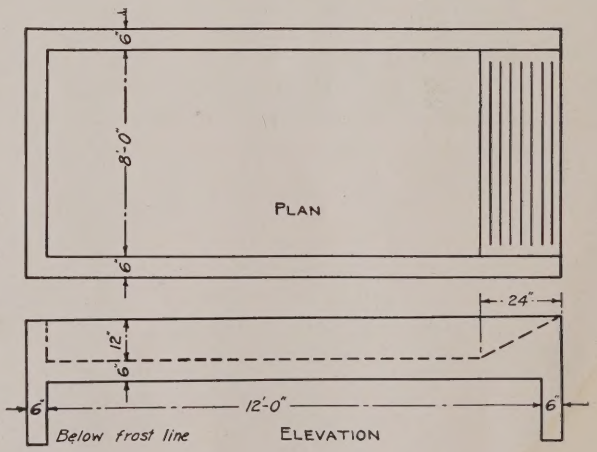
The concrete should be mixed in proportion of 1:2:3½, being 1 part of cement, 2 parts of sand, and 3½ parts of stone or gravel graded in size from ¼ inch to 1½ inches. It should be mixed with the least amount of water to give it workability. Deposit the concrete in layers about six inches deep, and thoroughly pack it to obtain a dense mass. The floor should be finished with a wood float to provide firm and non-skid footing for the stock.

A list of the materials necessary to build the hog wallows shown in these plans is given below. Above all things, make certain of dependable materials, or else all your good workmanship can count for little.



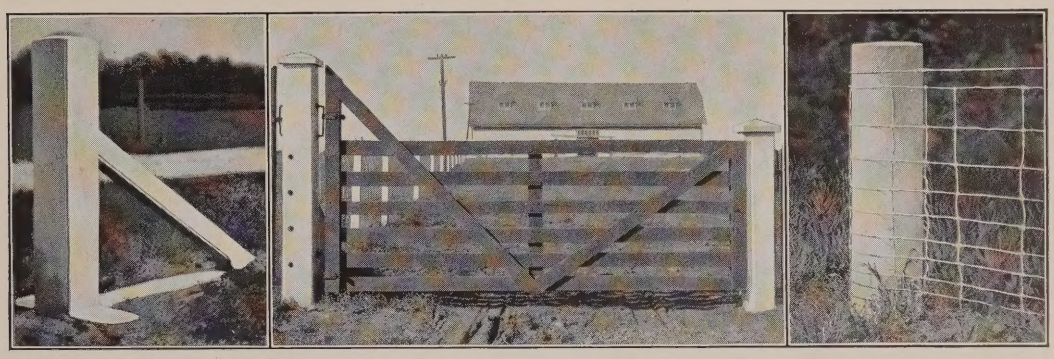
MATERIALS REQUIRED

Concrete Mixture, 1:2:3½	
Quantity of Concrete	93 cu. ft.
Lehigh Cement	22 sacks
Sand, ¼ inch and under	1⅔ cu. yds.
Stone, ¼ inch to 1½ inches	2⅞ cu. yds.



MATERIALS REQUIRED

Concrete Mixture, 1:2:3½	
Quantity of Concrete (allowing for footings 2 feet deep)	128¾ cu. ft.
Lehigh Cement	30 sacks
Sand, ¼ inch and under	2¼ cu. yds.
Stone, ¼ inch to 1½ inches	4 cu. yds.



Concrete Fence Posts

CONCRETE fence posts are a permanent improvement to a property. They will stand for years without deterioration, whereas wooden posts rot, burn, or become riddled by wood borers. The first cost of concrete fence posts is the only cost, whereas hardwood posts cost almost as much and last but a few years. Concrete posts are easily constructed, and the work can be done in winter months or when outdoor work is not possible.

The various types of commercial post molds on the market are not expensive and will be of advantage if many posts are needed. Molds can also be made with clear, straight-grained lumber. Before using wooden molds saturate them with a mixture of boiled linseed oil and kerosene to prevent the concrete from sticking. Reinforcing rods are placed in the proper position while filling the molds. Jarring or tapping the molds and stirring the concrete while filling will release air-bubbles and work the coarser particles away from the surface, producing a smooth finish.

Steel rods, ¼ inch to ⅜ inch round, must be placed in concrete posts to resist strains. To be most effective, these rods must be correctly placed. In a square post, the reinforcing should be placed near the surface at each of the four corners. Correct positions for reinforcing rods for the various shaped posts are illustrated.

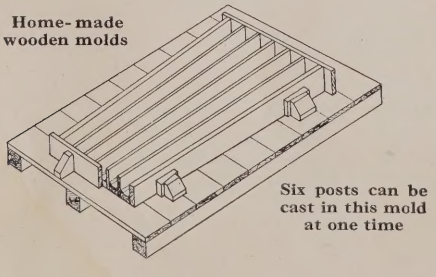
A 1:2:3 mixture (one part cement, two parts sand, and three parts gravel or broken stone) is best for concrete posts.

Clean coarse sand, ranging from fine particles up to those ¼ inch in size, should be used, and the pebbles or broken stone should be graded from ¼ inch to a maximum size of ½ inch.

The posts, as soon as removed from the molds, should be protected from excessive cold, sun, and dry winds. Harden them by covering with straw, and keep wet for a week or ten days. At the end of this time move them outside and stand on end. Thirty days later they are ready for use.

There are many methods of attaching line wires to concrete posts, but the most practical and simple way is to tie the fencing to the post by wire loops such as are used by telegraph linemen in attaching wires to insulators. Attach the tiewire to the fence, carry it around the post, and again fasten to the fence.

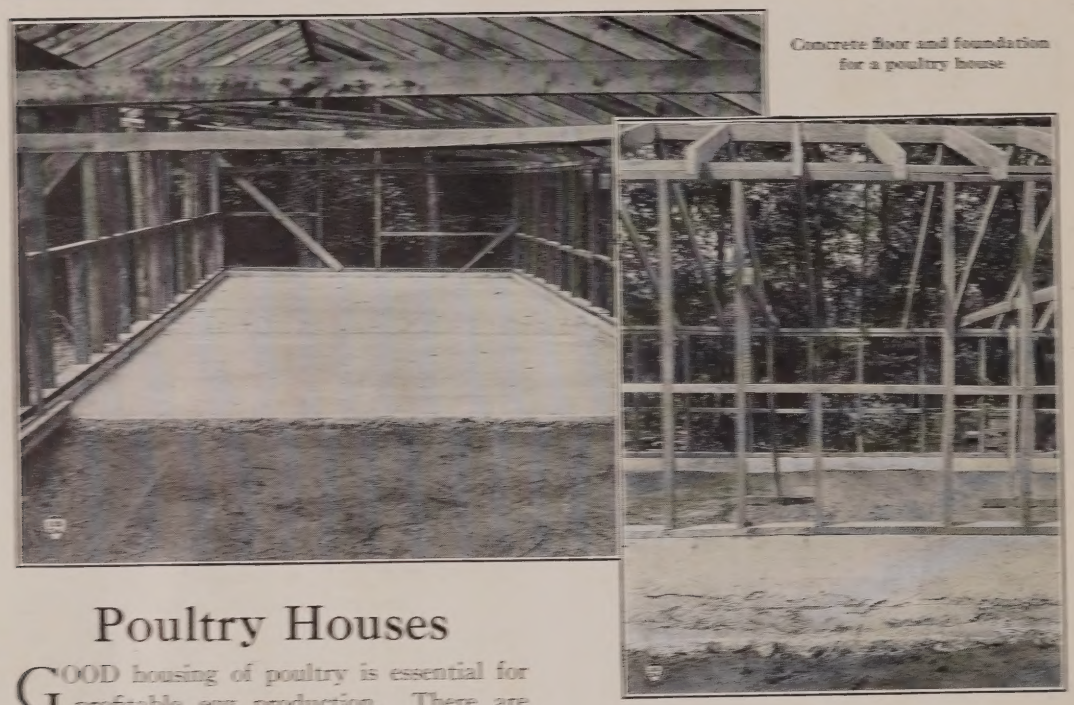
While staples may be cast with the post, they make it necessary to set all posts at the same depth, which is not always practicable. Holes cast in posts cause a weakness except in the case of large corner or gate posts.



Home-made wooden molds

Six posts can be cast in this mold at one time

Reinforcing rods must be placed at points of greatest stress



Concrete floor and foundation for a poultry house

Poultry Houses

GOOD housing of poultry is essential for profitable egg production. There are many good types of poultry houses, and the poultryman, in making his selection, must consider not only his requirements, but also the climatic conditions of his locality.

A good poultry house should provide perfect protection from storms, sufficient sunshine during the winter months, plenty of ventilation without drafts, and uniformity of temperature. It should also be absolutely dry in winter as well as in summer.

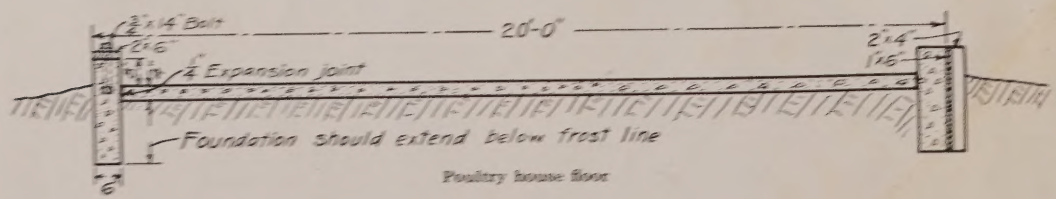
The poultry house should be located on high, well-drained ground. If the natural drainage is not adequate, a tile under-drain should be provided. Ground sloping to the south or southeast is best. A concrete floor and foundation is most durable and efficient, in fact, is the best form of construction for this purpose.

Foundation and Floor

Damp floors are the cause of much disease among poultry. A properly constructed concrete floor prevents seepage of the soil water and keeps the litter dry. Furthermore, because of its smooth, hard surface, it is easily swept, washed, and disinfected.

A newly laid concrete poultry house floor should have plenty of time to dry thoroughly before being used, as fresh concrete contains considerable moisture. If time is a factor, it is best to install the floor first and build the superstructure afterward. When thoroughly dry, a concrete floor is not cold, and as a poultry house floor should always be deeply covered with litter, the birds will have little contact with the floor.

A good foundation will keep rats from burrowing under the floor and will prevent heaving by frost. This foundation should extend below the frost line. The floor is made 4 inches thick. A cinder sub-base is used only where drainage is necessary. Well-packed earth is usually sufficient.



Poultry house floor

A poultry house with a rear concrete wall as high as the dropping boards. The two-story building at the far end is a feed house

A mixture of 1:2:3½ concrete (1 part of cement, 2 parts sand, and 3½ parts gravel or stone) is recommended. Gravel or stone up to one inch in size should be used. Forms for the foundation walls are first set up and the concrete poured. Then the floor slab is placed and is well tamped to make a dense, solid mass. Finish with a steel trowel to obtain a smooth surface. Rough-finished concrete floors may have a tendency to wear away the toe-nails of the birds when deep litter is not used.

An expansion joint between the foundation wall and the floor is shown in the drawing. This may consist of several layers of roofing paper. Its purpose is to provide for the expansion and contraction of the floor due to temperature changes. Without such a joint, the foundation walls may be damaged.

Bolts should be embedded in the wall every ten feet, to fasten the sills. If foundations are necessary for interior posts, they may be built with box forms at the time the floor is laid.

Exposure to sun and wind immediately after completion deprives concrete of a great deal of strength. To cure the floor properly, allow it to dry slowly. Cover it with a few inches of straw and keep wet for several days or a week.

A concrete manure pit built at one end of the poultry house

Manure Storage

Poultry manure is rich in nitrogen—the highest priced element in any fertilizer. Whether it is to be sold or used on the poultry farm, its value should be carefully conserved. Unless it is properly stored, the nitrogen will be liberated and will pass off into the air.

A storage pit for poultry manure can readily be constructed at one end of the poultry house. Concrete floors and walls are necessary for permanence. The roof must be watertight.

A poultry house should have floors and foundation walls of concrete

Incubator Cellar

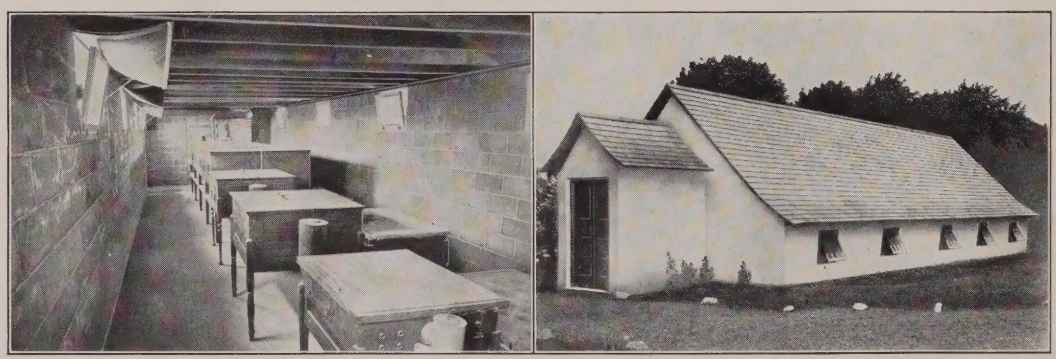
A properly constructed incubator cellar, partly below ground, will provide ideal conditions for hatching. Temperature, ventilation, and moisture must be under control regardless of weather conditions. If sudden changes in the outside temperature affect the incubator room, constant attention will be necessary. Sunlight should never shine on the incubators, as the thermostat will be unable to correct the rapid rise in temperature.

Fresh air is essential, the humidity should be fairly high, and there should be ventilation for both the light gases near the ceiling and the heavy gases that settle to the floor.

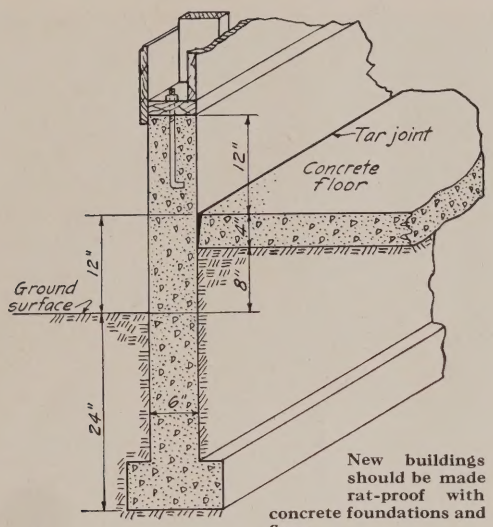
A cave cellar, with a grade entrance, if possible, and a top ventilator, will provide an excellent place for the incubators. The walls should be solid concrete or concrete block, and should be two-thirds below the surface of the ground in order to provide good insulation against temperature changes.

Feed Room

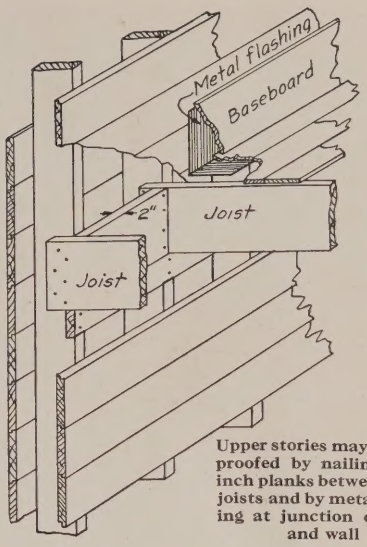
A good feed room will prove an economy on every poultry farm. Often it can be constructed as a part of the poultry house. The floor should be of concrete, and the foundation wall should be extended several feet above the floor level, as an effective barrier against rats. Bins should be provided wherever bulk storage of feed is necessary. Sufficient floor space should be allowed for the mixing of feeds.



An incubator cellar provides ideal conditions for hatching



New buildings should be made rat-proof with concrete foundations and floors



Upper stories may be rat-proofed by nailing two-inch planks between floor joists and by metal flashing at junction of floor and wall

Building Out Rats

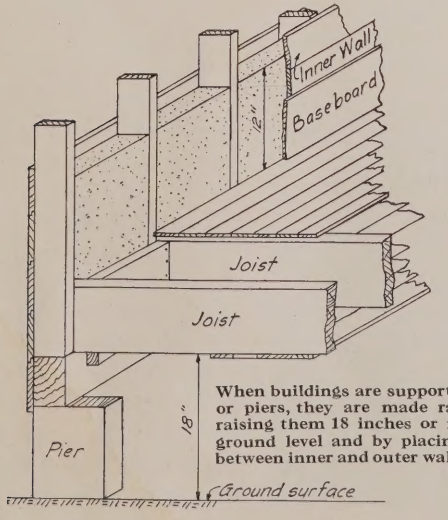
RATS destroy and waste great quantities of grain. They are a menace to health because they carry disease.

All farm buildings should rest on concrete foundations and have concrete floors, even though the building itself is not concrete. Therefore, the first step in rat-proofing is to construct all ground level floors of concrete. These floors should be no less than four inches thick, and should be placed directly on the soil, so there will be no space underneath for rats to find shelter.

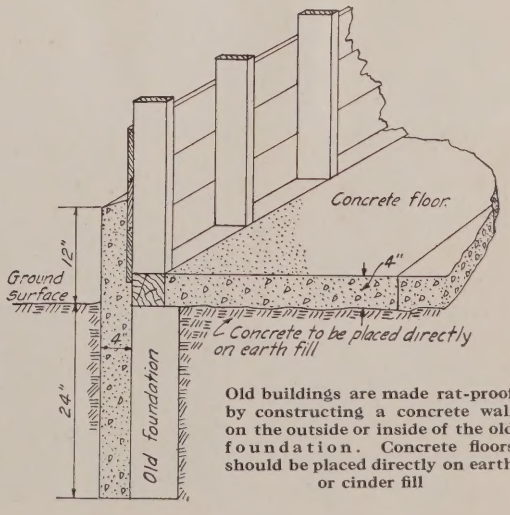
Foundations must be carried 24 inches below ground level, to prevent the rats from burrowing beneath them. The concrete foundation should also extend 12 inches above the floor.

Old buildings can be given an effective rat-proofing by carrying up false foundation walls on the outside to such a height that the rats cannot find a resting place while attempting to gnaw into the building. Floors and foundation walls should be so joined that there will be no gap of earth through which the animals can burrow into the building.

The accompanying illustrations will show the various methods of rat-proofing in both old and new buildings.



When buildings are supported on posts or piers, they are made rat-proof by raising them 18 inches or more above ground level and by placing concrete between inner and outer walls above sill



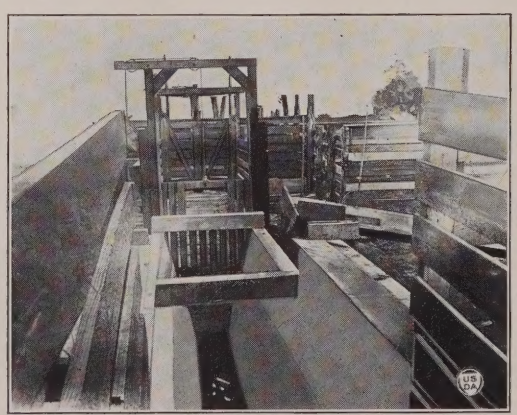
Old buildings are made rat-proof by constructing a concrete wall on the outside or inside of the old foundation. Concrete floors should be placed directly on earth or cinder fill

Concrete dipping vat for cattle

Concrete Dipping Vats

HOGS, sheep, and cattle require the use of a dipping vat at various times to eradicate ticks and parasitic skin troubles. To give permanent satisfaction, a good vat should be watertight, as it should hold the dipping solutions without leakage provided a cover is made to prevent evaporation. The most permanent, economical, and satisfactory vat for such work, free from rotting, rusting, and corroding, is one of concrete construction.

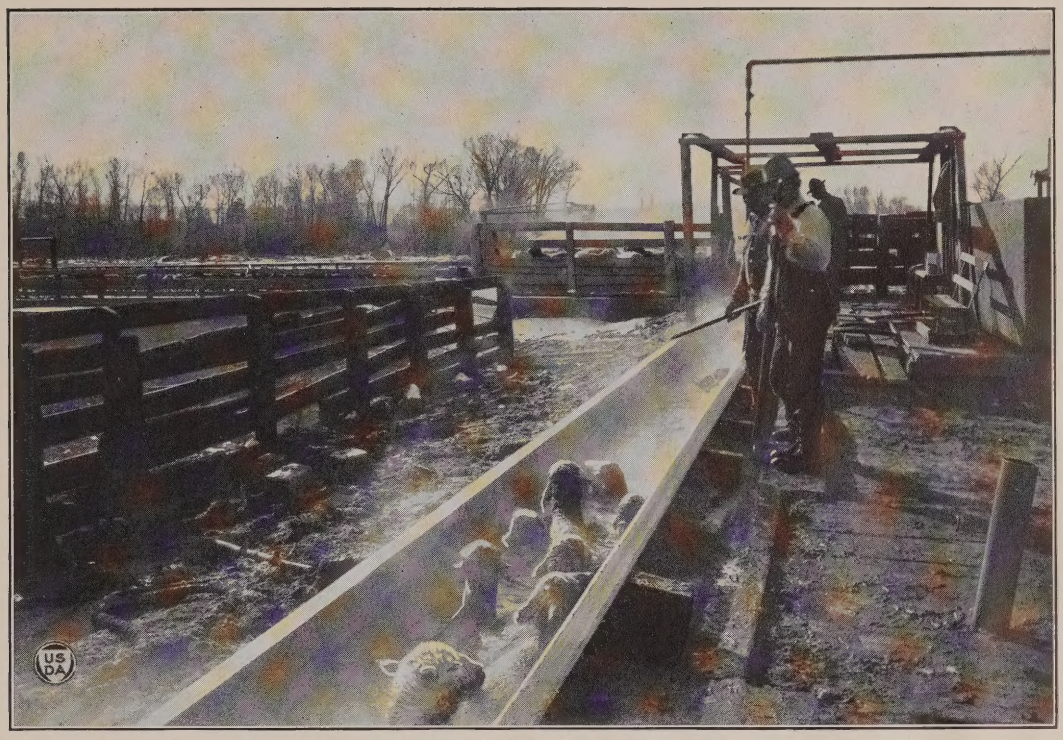
The drawing on the next page shows the general construction details of a vat. The size will vary according to its use. Dimensions of vats for horses, cattle, sheep, and hogs are given in the chart below the drawing, the letters at the top of each column corresponding to those shown in the diagram. The draining pens should be made large enough to accommodate the animals to be dipped. A vat with sloping sides is generally considered more desirable than one with straight sides, because of the saving in quantity of dipping solution needed.



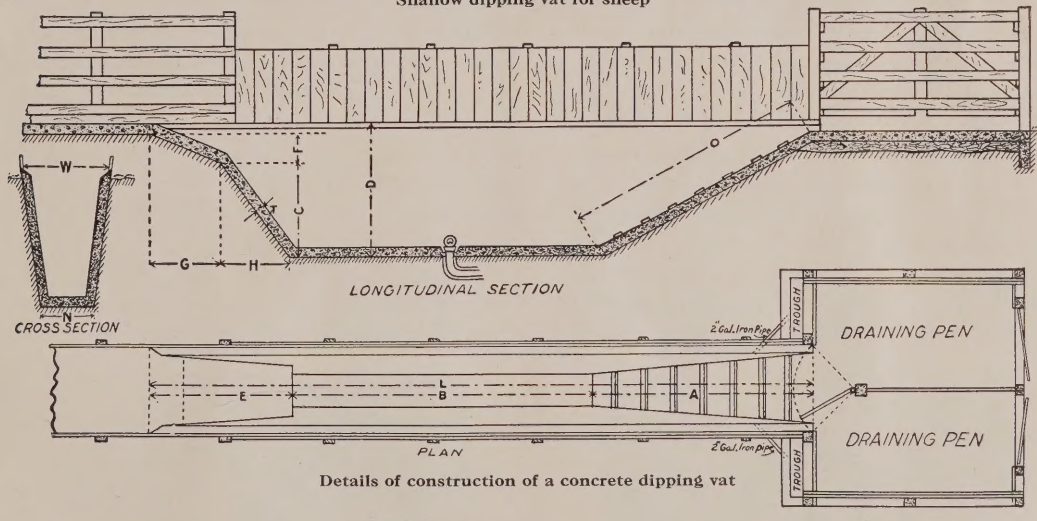
If the excavation is carefully made and the earth is firm, the sides of the trench may be used in place of an outside form. Bolts for fastening the boards in the exit incline should be placed in position in the forms before the concrete is poured. The floor and walls should be reinforced with woven wire or half-inch rods, to enable the vat to withstand the heaving of the ground in cold weather.

A 1 : 2 : 3 mixture (1 part cement, 2 parts sand, and 3 parts gravel or stone) will make watertight concrete.

Finish the walls with a steel trowel to obtain a smooth surface. For the floors, a rough surface is desirable to keep the animals from slipping. This can be secured with a wood float when finishing the floor.



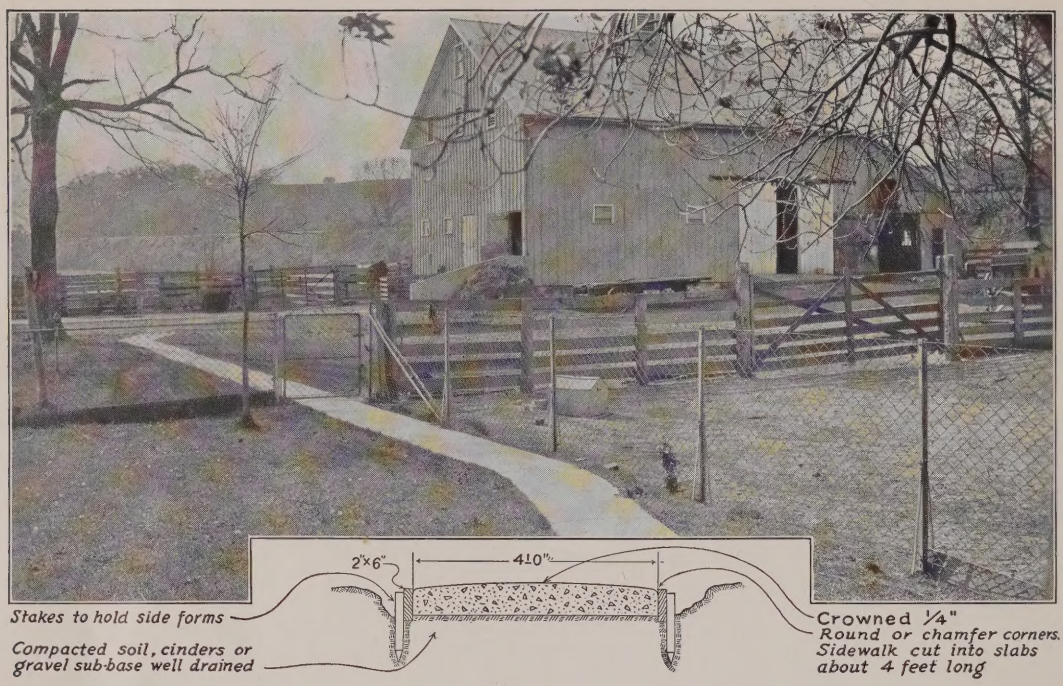
Shallow dipping vat for sheep



Details of construction of a concrete dipping vat

Kind	W		N		D		L		E		B		A		G	
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.
Horses	5	10	3	4	8	8	55	0	7	6	31	0	16	6	3	9
Cattle	5	4	3	4	7	8	51	0	6	8	31	0	13	4	3	4
Sheep	3	4	2	4	5	8	46	0	5	0	31	0	10	0	2	6
Hogs	3	4	2	4	5	8	36	0	5	0	31	0	10	0	2	6

Kind	F		H		C		O		T		Cement	Sand	Stone
	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Ft.	in.	Barrels	Cu. yds.	Cu. yds.
Horses	2	2	3	9	3	9	18	7	0	8	43	13	26
Cattle	1	11	3	4	3	4	15	4	0	8	37	11	22
Sheep	1	5	2	6	2	6	11	6	0	8	24	7	14
Hogs	1	5	2	6	2	6	11	6	0	8	19	5½	11

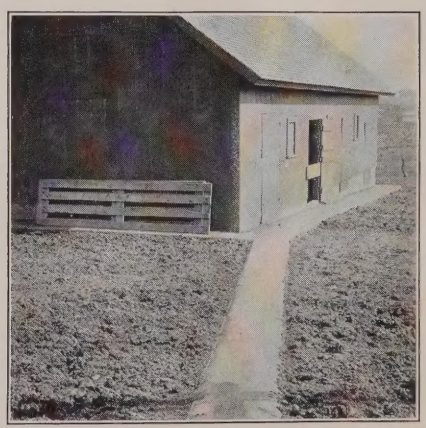

2"x6"
4'0"
Stakes to hold side forms
Compacted soil, cinders or gravel sub-base well drained
Crowned ¼"
Round or chamfer corners.
Sidewalk cut into slabs about 4 feet long

Concrete Walks and Steps

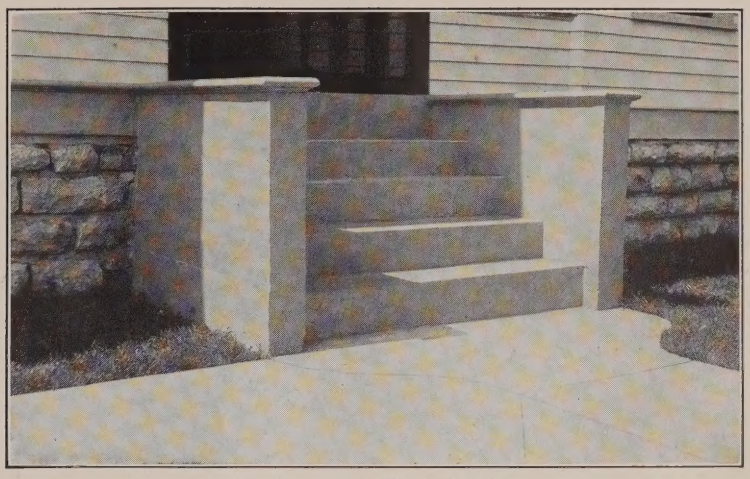
CONCRETE pavements should rest on a firm, well-compacted base. Soft spots should be dug out, filled with clean gravel, and tamped. Good drainage beneath the pavement should be provided when necessary. A specially prepared sub-base of gravel or cinders is seldom required if the natural soil drains freely, is well compacted, and slopes slightly so that free drainage is always present.

If the soil is dense and tends to be water-logged during protracted rainy spells, a special sub-base of gravel or cinders may be necessary. Unless this is properly placed, however, it may cause more difficulties than would its omission. If this sub-base is nothing more than a filled trench, it will collect water and make the walk unstable, and expansion due to freezing would heave the walk and break the slabs or throw them out of level.

It is important that each slab in a concrete walk be completely independent of adjoining ones. The joint marking the end of one slab and



Clean walks from the house to the barn save many hours of labor for the women on the farm



Concrete steps with cheek walls

the commencement of another should be continuous through the concrete to the soil upon which it rests, in order that any slight disturbance of the walk, due to upheaval or settlement, can be corrected by raising or lowering the slabs.

A concrete walk should be built throughout its thickness of one relatively rich mixture of concrete, such as 1:2:3 or 1:2:4 (one part cement, two parts sand, and three or four parts of gravel or stone).

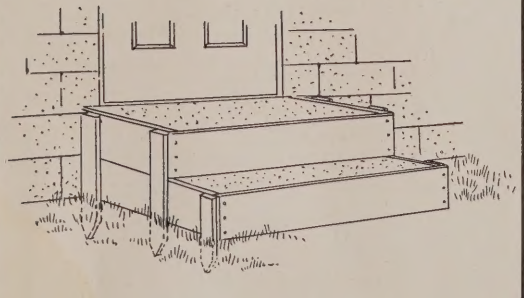
Concrete Steps

Steps receive hard wear. They are exposed to rain, snow, and ice, and are usually in contact with the soil. Unless made of concrete, they are the first part of a building to require repairs. Steps of concrete need be built but once—they are there to stay. They do not wear out, and the treads never become loose and unsafe.

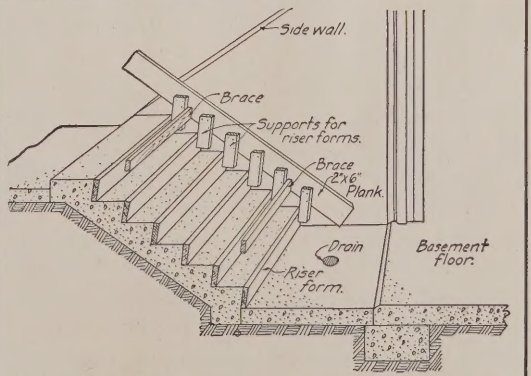
Construction details for outside steps leading to the basement are also illustrated. Forms are not needed for the under side, as the concrete is placed on the soil. The side walls are placed first in the same manner that a foundation wall would be built. Earth is then filled in and thoroughly tamped to provide a firm base on which to place the steps. The riser forms are supported by a 2 by 6-inch board braced against the side walls.

The treads of concrete steps should be finished with a wood float to provide a non-slip surface.

A 1:2:4 mix (one part cement, two parts sand, and four parts of gravel or stone) is recommended for concrete steps.



The dimensions of steps can be varied by simply changing the setting of the forms



Concrete basement steps are not hard to build by the use of easily made forms

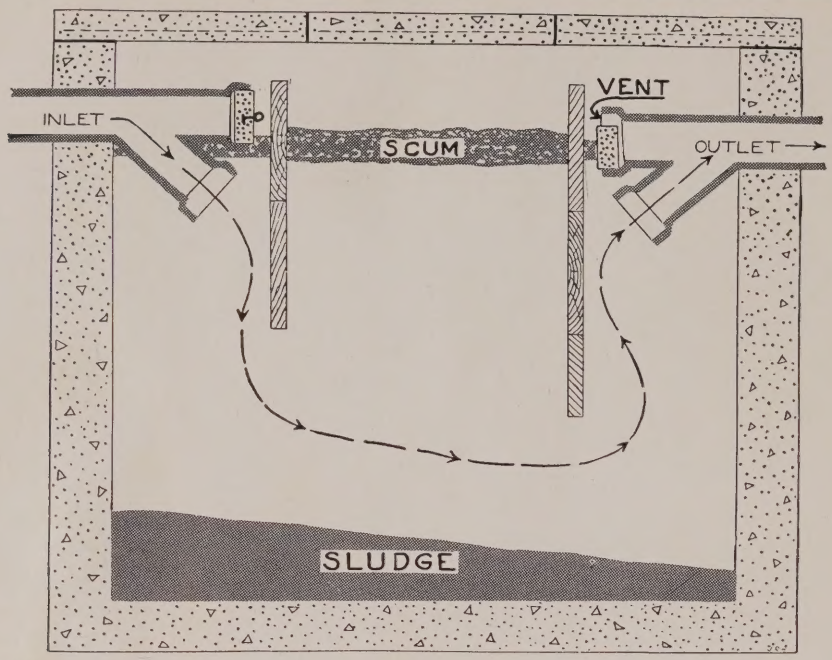


Fig. 1.—Section of tank in operation

Septic Tanks

THE installation of running water and bath rooms in many farm homes has created the necessity for a method of sewage disposal. The most satisfactory system for this purpose is a concrete septic tank, with a line of drain tile further to purify and distribute the liquids discharged from the tank.

A septic tank is a watertight compartment through which a slow current of sewage passes. While passing through the tank the sewage is worked on by bacteria and most of the solids are turned into liquid and gas. The liquid leaving the tank is then distributed by subsurface irrigation.

The use of concrete in the building of a septic tank permits easy construction with the added advantage of low cost and durability.

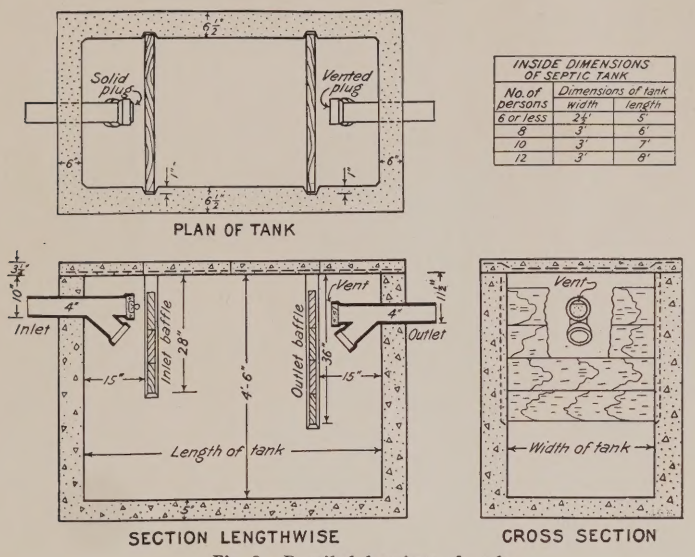
The location of the septic tank will depend on the size and the slope of the available ground. It is desirable to have 25 to 50 feet of sewer pipe between the house and the septic tank, with a grade of not less than ⅛ inch to the foot, nor more than ¾ inch to the foot.

The tank should be large enough to hold one day's flow of sewage, in addition to an accumulation of sludge and scum, and have an extra depth of from 10 to 12 inches in the upper part of the tank; hence the size will depend largely on the number of people in the household.

If the earth walls of the excavation are firm and the hole has been carefully dug, the pit will serve as an outside form. The inside form should be made as shown in the drawings. Forms should be made of unmatched, ⅞-inch boards, 5 to 6 inches wide, with corner posts of 2 x 4-inch material.

The boards for the ends of the form are cut 2 inches shorter than the inside width of the tank, and are nailed securely to the edge of the corner posts for a distance of about 30 inches up from the bottom. The remaining end boards are to be attached with light nails, just long enough to hold them in position, as it will be necessary later to separate the posts from these boards in removing the form. The holes for the inlet and outlet fittings should be cut at this time.

The boards for the sides should be cut beveled at the ends, as shown in detail in figure 4, so as to facilitate their removal from the concrete. They should then be nailed



INSIDE DIMENSIONS OF SEPTIC TANK		
No. of persons	Dimensions of tank	
	width	length
6 or less	2½'	5'
8	3'	6'
10	3'	7'
12	3'	8'

Fig. 2.—Detailed drawings of tank

Inside Dimensions	Mixture	Concrete	Cement	Sand	Gravel
2½' x 5' x 4½'	1 : 2 : 4	48¼ cu. ft.	10½ sacks	⅘ cu. yd.	1⅗ cu. yd.
3' x 6' x 4½'	1 : 2 : 4	61 cu. ft.	13 sacks	1 cu. yd.	1⅘ cu. yd.
3' x 7' x 4½'	1 : 2 : 4	68 cu. ft.	14½ sacks	1⅛ cu. yd.	2¼ cu. yd.
3' x 8' x 4½'	1 : 2 : 4	75½ cu. ft.	16 sacks	1¼ cu. yd.	2½ cu. yd.

securely to the 2 x 4 upright, to which the center bracing is to be fastened.

In order to form slots in the concrete in which to place the baffles, beveled cleats are nailed in their proper places, as shown in figure 4, care being taken to place the two 28-inch cleats at the inlet end of each side form, and the 36-inch cleats at the discharge end.

Do not nail through the side boards into the corner posts; instead, nail from the inside through the corner posts into the side boards. Do not drive the nails completely, as they will have to be withdrawn later.

Forms for the cover slabs should be made at the same time as the forms for the tank.

Tank Details

Inlet and outlet fittings for the tank consist of 4-inch Y-branch sewer pipe. The level of the outlet is so arranged, by a drop of 1½ inches through the tank, that the branch pipe of the inlet is covered with water, but water does not stand in the inlet pipe itself. The method of locating the inlet and outlet levels is shown in figure 3. The fittings are set level, with the U-branch downward. In this manner the sewage enters the tank without disturbing the scum and does not drag air in with it.

The upper end of the Y-inlet pipe should be closed with a solid plug in order to prevent the escape of foul gases. This plug may, if necessary, be removed for cleaning the pipe. A vented plug in the outlet pipe permits the escape of gases into the soil through the disposal tile. To construct these plugs, place the tile on end with the bell end up. For the inlet fitting, place a tin disc in the bottom of the bell, rub the sides of the bell with a thin coating of grease or oil, and fill with a mortar made of one part of cement and three parts of sand. For the outlet fitting, cut the tin with a projecting side which is bent up to leave a vent on the side of the bell above, or away from, the side branch.

Placing the Concrete

A 1:2:4 concrete mixture (1 part cement, 2 parts sand, and 4 parts gravel or stone) is recommended.

The floor, 5 inches thick, should be poured first and thoroughly tamped. The inside form can now be suspended in the pit, as illustrated in figure 5, the lower edge just resting on the concrete. The walls should now

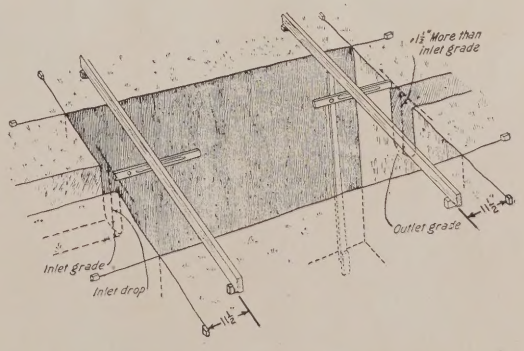


Fig. 3.—Showing method of locating inlet and outlet grades with a level held against the bottom of the cross-pieces. Stick to measure depth of excavation is also shown. The 5-inch addition at the bottom can be removed and the stick used as a guide in laying the concrete floor

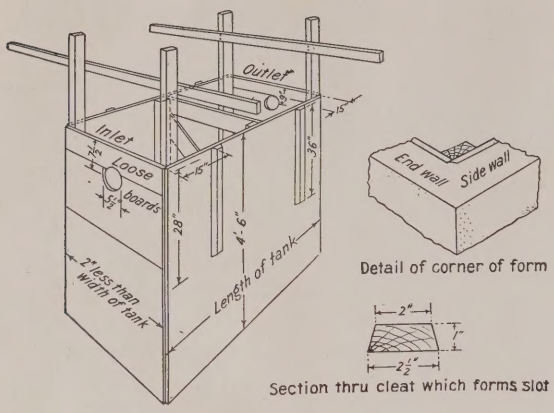


Fig. 4.—Form for building tank

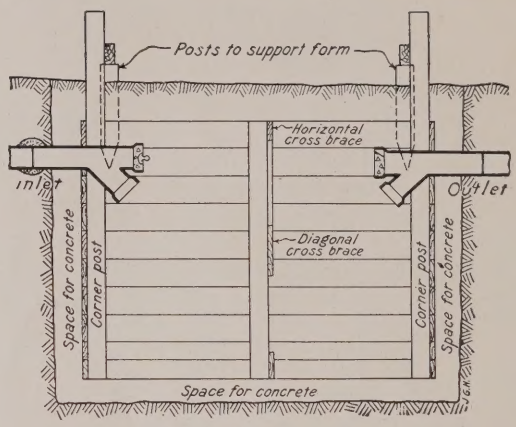


Fig. 5.—Form in place

be placed in the forms in layers 6 to 10 inches deep, each layer being tamped until water comes to the surface. The side walls are 6½ inches thick and the end walls 6 inches thick. When the walls have been filled almost to the holes for the inlet and outlet, these pipes, plugged as previously described, should be put in place, and the pouring continued until the walls are completed. Care should be taken to pack the concrete well under and around these Y-branches, and they must not project into the tank far enough to prevent the insertion of the baffle boards.

Forms for the cover slabs can be filled at this time. The slabs should be reinforced with a good grade of metal lath placed ¾ inch from the under side of the slab.

Removing the Forms

Sufficient time should be allowed for the concrete to harden thoroughly before removing the forms—usually from five to seven days. First remove the center brace, then draw the nails that hold the 2 x 4-inch corner pieces to the sides, and then remove the ends of the form. The sides, with the cleats attached, may now be removed, leaving the slots for the baffle boards. The baffle boards, made of 2-inch planks, preferably of cypress or chestnut, can now be put in place. The inlet baffle prevents agitation from incoming sewage and virtually extends the inlet pipe downward to the center of the tank; the outlet baffle prevents large solids from leaving the tank. These baffles are necessary to prevent a direct current forming from the inlet to the outlet.

Over the septic tank there should be a covering of earth sufficient to maintain vegetation, but not so great as to offer serious difficulty in uncovering the tank for inspection or cleaning. A depth of about 12 inches is usually satisfactory. In level ground this will place the outlet sewer pipe about 27 inches below the surface of the ground. Since it is desirable to have the tile in the absorption area within 12 to 18 inches of the surface, the absorption area should, if possible, be at a level at least 1 foot below the proposed location of the septic tank. If the ground is fairly level, this may require locating the absorption area at some distance from the septic tank, or placing the tile at a greater depth and in greater number to compensate for this greater depth.

In a soil containing much sand or gravel 10 to 20 feet of absorption tile per person will be required, while in a loam 30 to 50 feet per person is necessary. Where more than one row of tile is needed, the rows should preferably be at least 6 feet apart, and better results would be obtained by leaving a space of 10 feet between them.

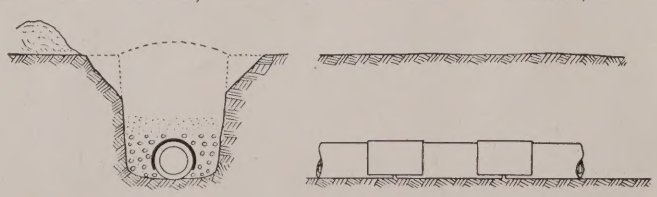


Fig. 6.—Absorption tile laid in trench with tar paper over joints, surrounded with gravel and the top soil placed directly above the tile.

Foundations and Walls

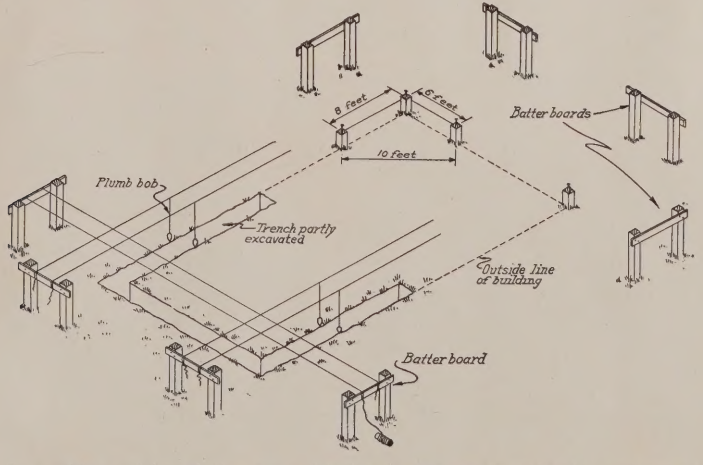
THE thickness of foundation walls depends upon the load to be carried. Walls for houses, garages, and barns range in thickness from 6 to 10 or 12 inches. Foundation walls for buildings without a basement need not be made of a very rich mixture, as absolute watertightness is not necessary. Therefore, a 1:2½:5 or 1:3:6 mixture may be used. For watertight wall construction a 1:2:4 or 1:2½:4 mix (in extreme cases, where much ground water is to be encountered, a 1:2:3 mix) should be used for the foundation walls of buildings with basements.

Where soil conditions lack good supporting capacity, the foundation wall is usually built on a footing. For small buildings, a good bearing area is usually secured by spreading out a footing about 10 or 12 inches wide and 6 or 8 inches thick. The average barn has walls from 8 to 10 inches thick, and may require a footing 2 feet wide and 12 inches thick to support the load. For a two-story house having eight-inch walls soil conditions may require a footing 18 inches wide and 12 inches thick.

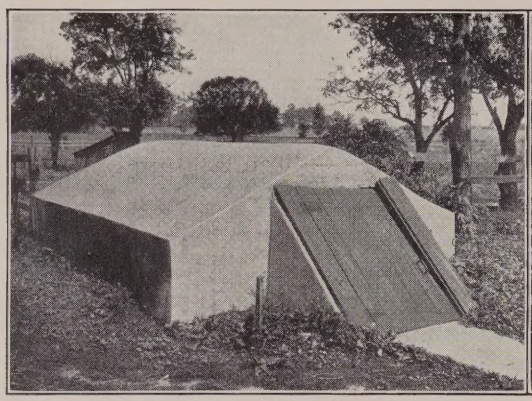
In excavating for foundations the trench should be carried deep enough so that its bottom will extend to firm bearing soil, below possible frost penetration. Otherwise upheaval due to expansion of the soil when freezing may cause cracking of the foundation, and the crack may possibly extend up into the structure of the wall.

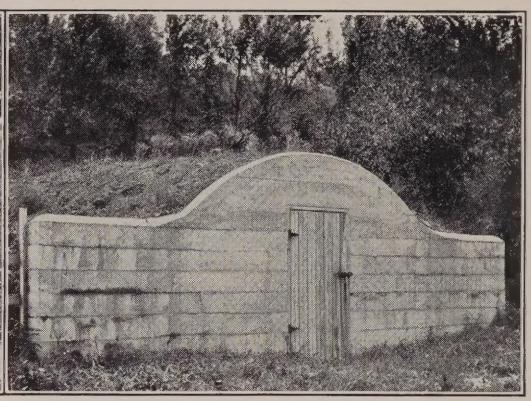
Monolithic walls above ground are usually made of a 1:2:4 or 1:2½:4 concrete.

Concrete block are used extensively in all kinds of foundation work, particularly for small and medium-sized structures. Usually an ordinary concrete footing is laid first and the block masonry wall started upon this. Be sure the block are well and uniformly bedded in a rich cement mortar, not leaner than 1:2½ or 1:3 (1 part of cement and 2½ or 3 parts of sand), and that all joints are well filled and pointed. If this is not done, there is danger of leakage. As an added precaution, block foundation walls are usually given a quarter-inch coat of rich sand-cement mortar on the exterior before the foundation trench is filled.



In marking out foundation areas this detail will be of considerable assistance





Fruit and Vegetable Storage

STORAGE cellars may be divided into two groups: those for the storage of fruit and vegetables for home use, and those for the storage of farm products awaiting the higher prices that usually follow after the bulk of a crop has been moved.

The successful farmer of today must be a merchant as well as a producer, and when he finds himself burdened with a crop for which a profitable market cannot readily be found, it will pay him to store it. Every fruit and potato grower should provide sufficient storage facilities for such an occasion. A good storage cellar made of concrete is a permanent investment that will pay for itself in one or two seasons.

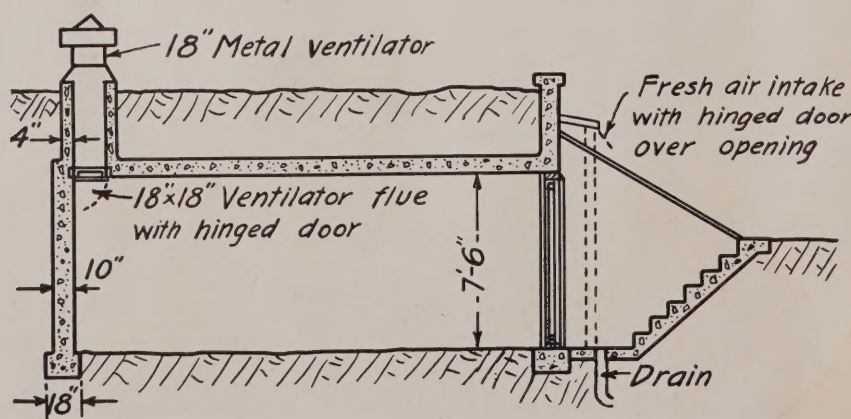
Detailed working plans for large storage cellars will gladly be furnished on request.

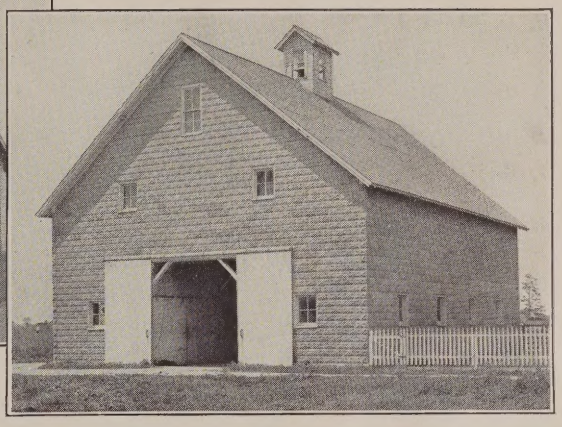
The home storage cellar can be constructed as shown in the drawing. An earth floor is recommended, as experience has proved that it aids greatly in controlling the temperature and humidity. Reinforcement is needed to give the roof the necessary strength to support the earth fill.

A 1:2½:4 mixture of concrete (1 part cement, 2½ parts sand, and 4 parts gravel or broken stone) is recommended for monolithic storage cellar construction. Concrete block may also be used for the walls. Concrete in the roof should be mixed in the proportion of 1:2:3.

REINFORCEMENT REQUIRED ACROSS THE ROOF OF A STORAGE CELLAR

Width of Span	Thickness of Concrete	Size of Bars Needed	Spacing, from Center to Center
8 feet	5 inches	½ inch	6½ inches
9 "	5½ "	⅝ "	9 "
10 "	6 "	⅝ "	8 "
11 "	6½ "	⅝ "	7½ "
12 "	7½ "	⅝ "	6 "
13 "	8 "	¾ "	8½ "
14 "	9 "	¾ "	7½ "
15 "	9½ "	¾ "	7 "
16 "	10 "	⅞ "	9 "





Farm structures built with concrete block are permanent, fireproof, and free from further maintenance costs

Concrete Block and Tile

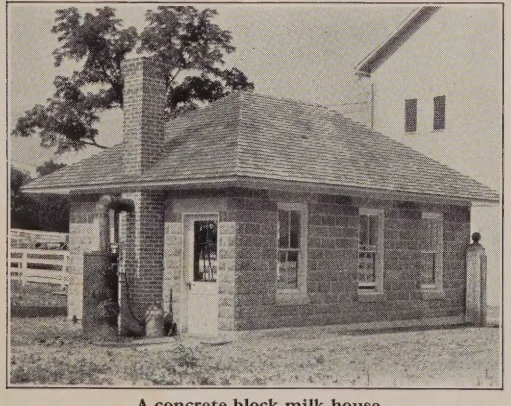
CONCRETE masonry is an adaptable and attractive building material for practically all farm structures. In most every community concrete block and concrete building tile are readily obtainable. These units are laid in a 1:3 Portland cement mortar (one part of cement and three parts of clean, well-graded sand), and as this mortar is a close approximation of the material used in making the blocks, an excellent bond is established because of the similarity of materials. Upright joints should be carefully spread with mortar on both outside and inside edges to insure a watertight wall. The practice of laying the block first and pointing the inside joint afterward often results in leaky walls which are a continual source of annoyance.

The advantages of concrete masonry farm structures are many. The buildings are rigid and substantial, and they are fireproof, rotproof, and sanitary. The sealed air spaces in a concrete masonry wall insulate the building against sudden changes in temperature.

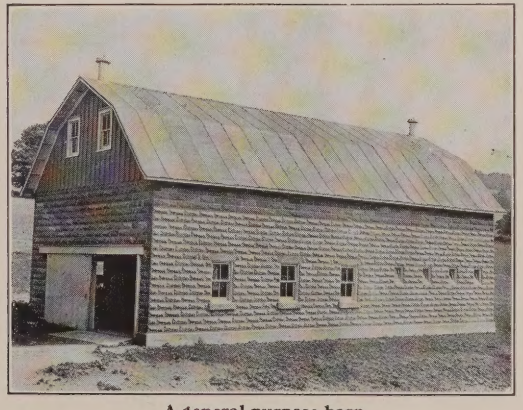
Forms are not needed to set up concrete block or tile, and the wall is available for immediate use as soon as the work is completed.

The usual size for concrete block is 8 inches thick and 8 inches high, with a 16-inch face. Concrete tile are made in a lightweight one-hand unit which greatly facilitates their use. The average size is 5 inches by 8 inches by 12 inches, and the weight is about 13 pounds.

Rough, flat-flaced block and concrete tile make an excellent backing for a stucco coat, providing a firm and solid base. If stucco is not to be used, imitation rock face and smooth-faced blocks are best.



A concrete block milk house



A general purpose barn

MANY people believe that the quality of concrete depends entirely upon the cement used. It is true that a high quality cement—Lehigh Portand Cement—should be used, but of equal importance are the selection of the other materials and the care exercised in the mixing.

Good concrete can be made by following these directions:

1. Specify "Lehigh" Cement.
2. Use clean, well-graded sand and stone.
3. Mix properly and completely.
4. Place carefully.
5. Use care while curing and drying.

Concrete is a product resulting from the proper mixture of cement, sand, stone or gravel, and water. Cement acts as a mineral glue, binding these materials firmly together.

Materials for Concrete

SAND, gravel, and stone vary in quality and must be selected with care. Sand is often dirty, due to the presence of foreign materials, such as silt or organic matter. Rotted vegetable material may be present in such a fine form as to be difficult to detect; or considerable clay may be in the sand. Practically the same impurities may be found in gravel or crushed stone, particularly in gravel. The pebbles may be coated with clay and foreign material, which will prevent the cement from binding the mixture firmly together as a mass.

Practically every gravel bank contains more sand than pebbles; in fact, the case is usually the reverse of what is best in making good concrete. It is highly desirable that a one-quarter-inch screen be used to separate the sand from the gravel. By so doing the proportions can be quickly gauged to conform to the requirements of the work at hand.

The usual proportions of concrete mixture require approximately twice as much gravel as sand, and a gravel bank which will produce such a proportion is almost unheard of. In concrete work, material that will pass through a one-quarter-inch screen is called sand. Material that will not pass this screen is called gravel. Therefore, if it is not possible to screen all the sand from the gravel, tests must be made regularly to determine the average

gravel and sand content of the run-of-bank material. This having been done, the proportion can be varied accordingly, which will provide a satisfactory mixture for the average small job.

A test to determine the presence of loam or organic matter in sand is easily made. Obtain a 12-ounce graduated bottle and fill to the 4½-ounce mark with the sand to be tested. Add to this a 3% solution of caustic soda (one ounce of caustic soda dissolved in 32 ounces of water will make a 3% solution), until the combined volume of sand and solution amounts to 7 ounces.

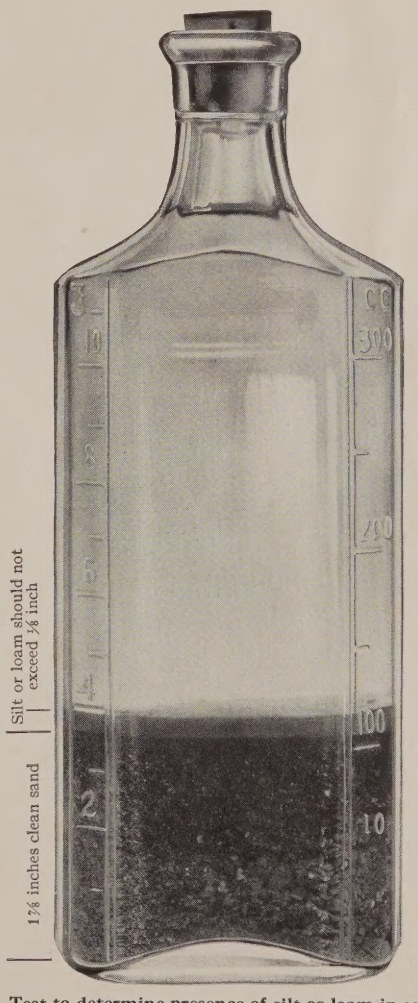
Shake thoroughly for a few minutes, and let stand for twenty-four hours. At the end of this time observe the color of the liquid above the sand. If the liquid is colorless or nearly so —a pale yellowish color—the sand is sufficiently free from organic impurities for use in high-grade concrete. A brownish-yellow liquid, or one darker than a pale straw, indicates a sand which should not be used in important concrete work, such as roads, pavements, and reinforced concrete building construction. If the color of the liquid is brownish throughout, the sand may be used in unimportant work only, such as footings or foundations that are not to carry heavy loads. A dark brown liquid shows a sand which should not be used for concrete work unless it can be washed to remove the foreign materials.

A very simple test to ascertain if the sand is free from silt or earth is made by placing two inches of sand in a bottle, fill with water, shake thoroughly for a few minutes, then allow to settle. If, after settling, there is ⅛ inch or more of sediment above the sand, washing is advisable.

Sand can be washed on an inclined platform 10 to 15 feet long, with a slope of 12 to 18 inches. Strips at sides and end will keep sand from washing away. A stream of water running through the sand from the upper end over the baseboard will remove the dirt. Pebbles and screenings from crushed stone can be washed in a similar manner.

Where bulk is required, and no great tensile strength is needed, hard cinders from soft coal are often used in place of gravel or stone in order to reduce the dead weight of the construction. For roof slabs on short spans and for base courses under cement finish, cinder concrete will prove economical. Due to the greater percentage of voids in cinders, a slightly increased amount of mortar (sand and cement) must be provided.

Within reasonable limits, the strength of the concrete increases with the size of the stone or gravel. In the general run of concrete work, including thin reinforced sections, the size should not exceed 1 or 1¼ inches. In mass concrete, such as heavy foundations and thick walls and floors, the size of the stone or gravel may often range up to 2½ or 3 inches. Round or egg-shaped particles of stone or gravel pack more closely and produce better concrete than flat, elongated pieces.



Test to determine presence of silt or loam in sand

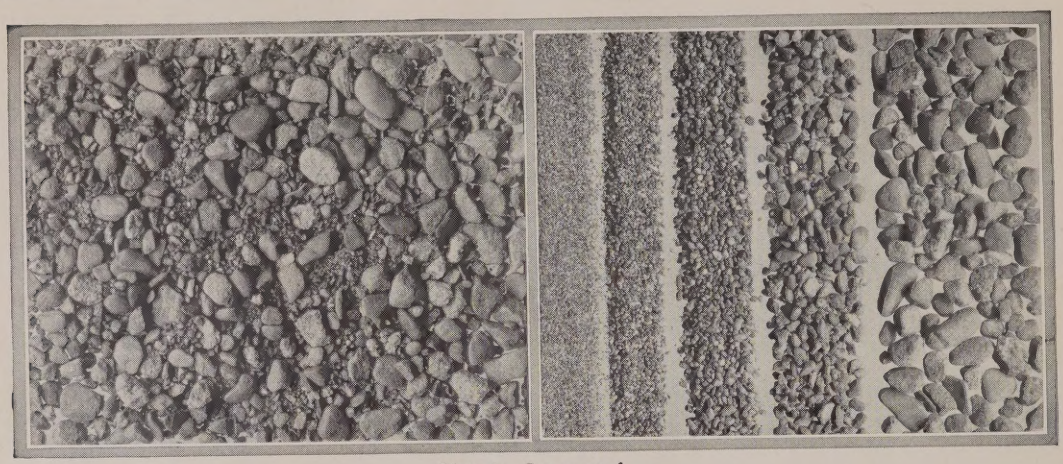


Plate 1.—Coarse sand

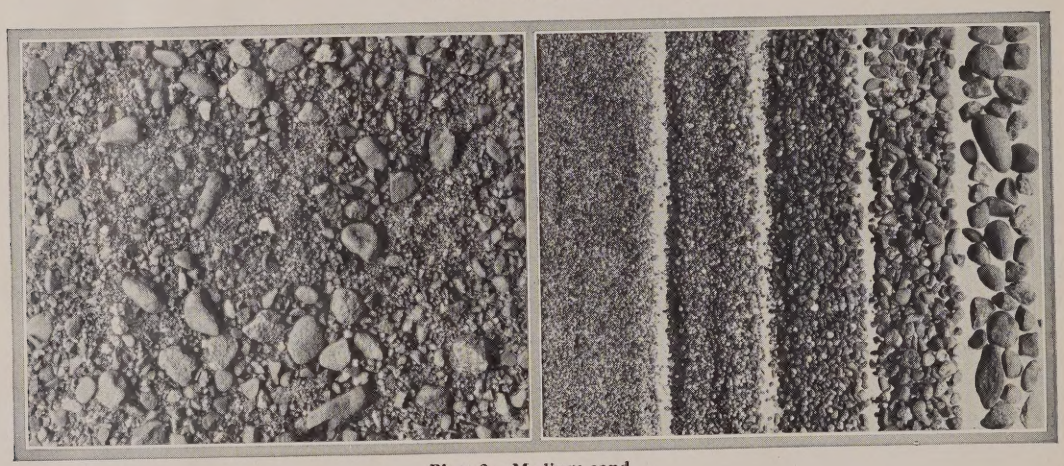


Plate 2.—Medium sand

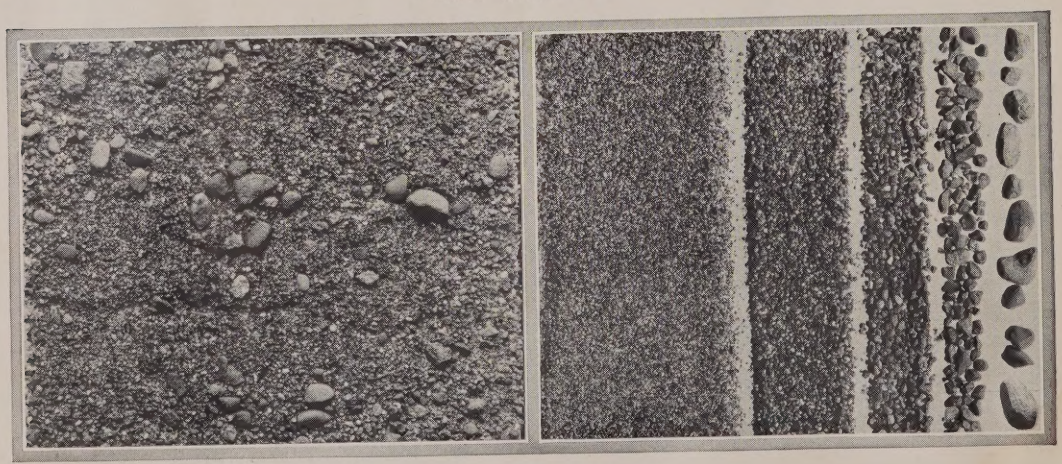


Plate 3.—Fine sand

Plates 1, 2, and 3 show three sands of different fineness. At the left is the sand as it appears when spread out on a flat surface; at the right the sand is shown separated into different grain sizes.

The sand in Plate 1 contains a very large proportion of coarse grains and is about as coarse as sand should be for use in concrete. This sand will give good *strength* in concrete, but it makes too harsh a mixture to allow the concrete to go into place properly without very careful attention to spading and working out air pockets.

The sand in Plate 2 is almost an ideal concrete sand, containing the same amount of grains of all different sizes.

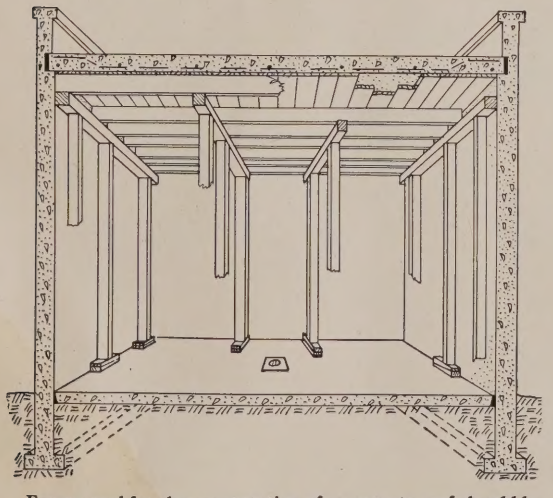
Plate 3 shows a very large proportion of fine grains and is about as fine as sand should ever be for use in concrete.

Forms for Concrete Construction

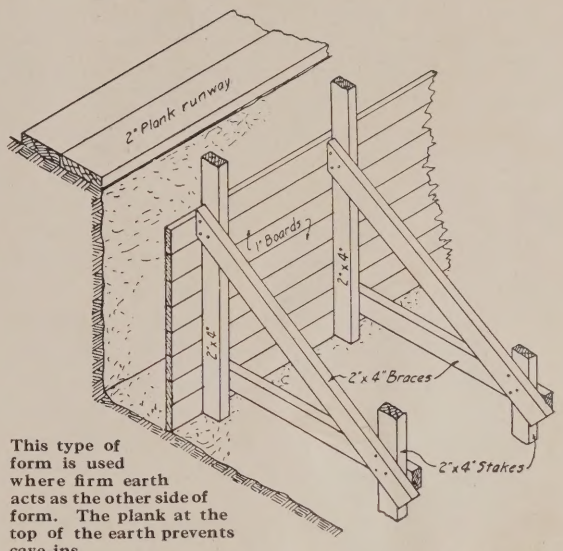
FOR most concrete work, the forms are easily made. A concrete walk or driveway, for example, requires 2 by 4-inch or 2 by 6-inch side strips to form the edges, and cross-pieces to limit the size of the various slabs into which the walk or drive is divided. In setting these forms it is necessary to level their upper surface or, if the work is not intended to be exactly level, then to set them so that the finished concrete surface will have the grade or slope desired.

Spruce and Norway pine is acceptable lumber for making forms and is reasonable in cost. For form work which requires great precision, such as window sills and lintels and other pieces of ornamental concrete, white pine will be found the best lumber to use. Hemlock is not very satisfactory for form work, as it splits and curls very easily.

All form lumber, regardless of where it is to be used, should be resurfaced on one side and one edge. In so doing the lumber will work much easier and will also provide a more satisfactory appearance. Lumber which is surfaced will make a much tighter form and will hold all the cement and sand, avoiding the possibilities of rock pockets and rough surfaces in the concrete. Ship lap or tongue and grooved lumber is most satisfactory.



Forms used for the construction of a concrete roof should be supported by plenty of strong posts. The bottom of these posts should rest on double wedges, as shown above, to facilitate easy removal. Few nails should be used



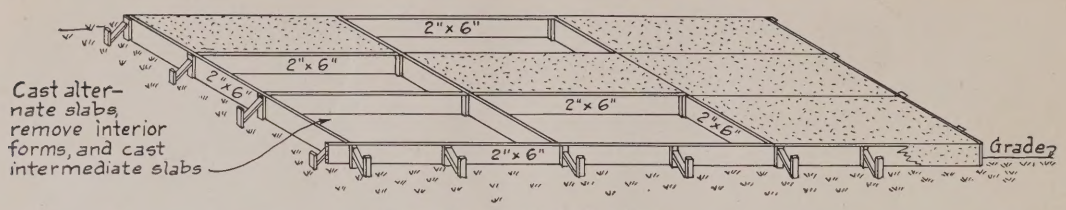
This type of form is used where firm earth acts as the other side of form. The plank at the top of the earth prevents cave-ins

For such concrete work as foundation walls below ground level, forms are unnecessary if the earth is firm enough to stand without caving. It is well to lay a plank along the edge of the trench, to assist in holding the bank upright, and to prevent the soil caving and mixing with the fresh concrete.

Good workmanship on forms is important because the appearance of the finished work is governed by the care with which forms are made and set up.

Considerable economy results from planning forms carefully before cutting lumber. Planning involves careful study of the working drawings of the structure or object to be built. It should be remembered that the inside surfaces of the forms lie against the concrete and thus reproduce the design, shape, or details intended. A projection designed on the structure calls for a depression in the face of the form to produce that projection. In other words, the form surface or interior face must be the reverse of the finished concrete surface or face.

For silos, grain tanks, chimneys, and other circular structures, as well as certain rectangular ones, metal forms have been devised. Such forms are in general use by silo builders and by building contractors specializing in concrete construction.



Forms for concrete feeding floor

To assist in salvaging the forms, use as few nails as possible, and do not drive them home. The forms can then be quickly removed and the lumber is available for other work.

It is customary to wet the forms during extremely dry weather before placing the concrete. This prevents the dry lumber from absorbing water from the concrete mixture, thereby depriving it of the moisture necessary for proper hardening.

Removal of Forms

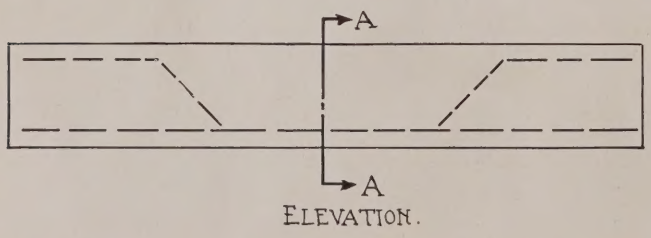
There is no set rule for the removal of forms. Under normal conditions forms are often removed within two days. It is much better, whenever possible, to allow them to remain much longer, as they assist materially in the proper curing and strengthening of the concrete.

To prevent concrete from sticking to small wooden molds, saturate them with crude oil. Oil drained from the crankcase of an automobile is also satisfactory for this purpose.

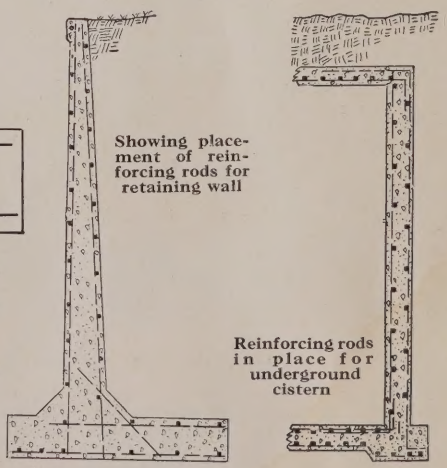
Back filling of earth should not be done in any case before a week has elapsed. Many excellent concrete jobs have been ruined by early back filling which has caused a terrific strain to be exerted against the comparatively green concrete. This often develops cracks which are both unsightly and unsatisfactory from a waterproofing standpoint.

Reinforcing Concrete

REINFORCEMENT is needed for concrete subjected to strains other than those of compression. The compressive strength of concrete is approximately ten times its tensile strength. Reinforcing metal of suitable size and shape, properly embedded in the concrete, will provide the necessary tensile strength for beams, overhead floors, walls, tanks, silos, or any other structures which carry loads. Concrete properly mixed and well placed adheres to steel and forms a firm bond. When loads are applied, the steel immediately takes its share of the strain. Reinforcing may be in the form of round, square, or deformed steel bars, or various kinds of expanded metal or wire mesh. The object of deforming the bars, either by lugs or depressions in the surface, is for the purpose of increasing the "mechanical bond" between the concrete and the steel.



Concrete beam supported on both ends. Rods placed along bottom, where tensile strength is required. Alternate rods bent up as some pull occurs at the top, near supporting points



Showing placement of reinforcing rods for retaining wall

Reinforcing rods in place for underground cistern

Reinforcing must be free from rust, grease, or any other foreign substance that would prevent the concrete from adhering to it. All rust in the form of dust, and particularly scale, should be removed with a wire brush. The bending of reinforcement should be done gradually, in order that its strength will not be impaired by small fractures. Steel reinforcing rods of all shapes and sizes may be obtained in most any hardware store. Mesh reinforcing, which is used to a great extent for slabs and floors, comes in rolls and a stock is usually carried in all communities.

To give the desired strength, reinforcement should be placed in exactly the position called for by the plans. The ends of mesh should be overlapped 4 inches or more and bound together securely by wire so as to prevent displacement during placing of concrete. Rods should be lapped about 30 times their diameter.

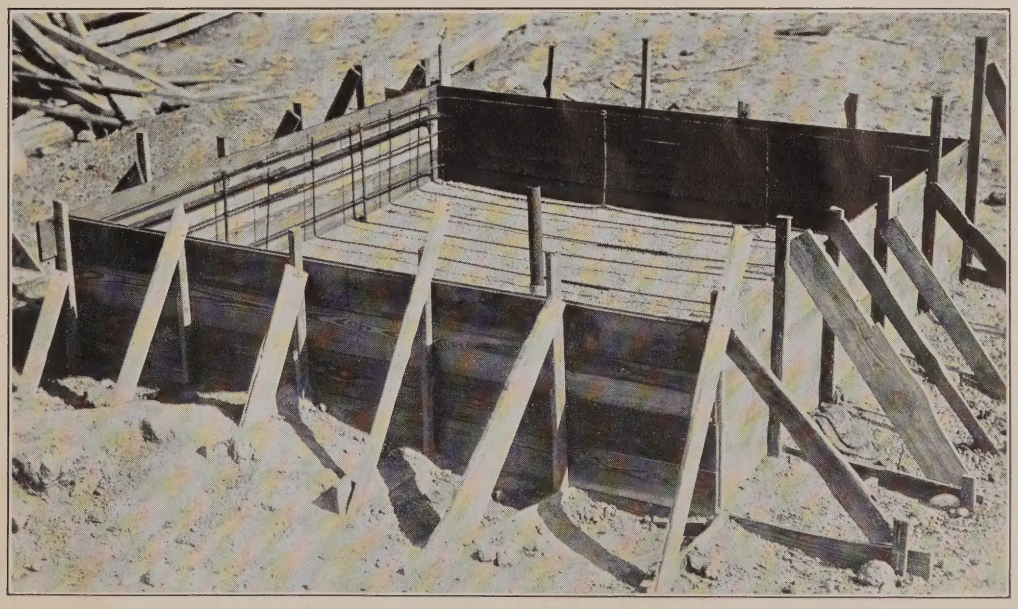
Steel is used instead of other metal for reinforcing concrete because it has practically the same ratio of expansion as concrete. In other words, all substances expand and contract under changing temperature conditions, and the rate of expansion in steel and concrete is so nearly the same that the bond between the concrete and steel is not broken.

For work of any great importance, or where it is necessary to suspend a thin section of concrete, which for that reason will require reinforcement, it is well to consult with an engineer who will design the reinforcing to provide for dead and live superimposed loads and eliminate the chance of failure due to faulty design.

Reinforcing steel is usually sold by the pound, and the table given below will assist in determining the number of pounds of steel which will be required.

AREAS AND WEIGHTS OF REINFORCING STEEL

Size—Inches	⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2
Round Bars—Lbs. Per Foot	.042	.167	.376	.668	1.043	1.502	2.044	2.670	3.380	4.172	5.049	6.008	7.051	8.178	9.388	10.681
Square Bars—Lbs. Per Foot	.053	.213	.478	.850	1.328	1.913	2.603	3.400	4.303	5.313	6.428	7.650	8.978	10.413	11.953	13.600



In reinforced concrete the rods are placed in certain positions so that the steel thus embedded will take the tension and safely carry the load

Proportioning Concrete

CONCRETE mixtures are specified as 1:2:3, etc. These figures represent the volume of each of the three materials used, always in the following order—cement, sand, and stone. Thus, a 1:2:3 mixture would be 1 bag of cement (which contains 1 cubic foot), 2 cubic feet of sand, and 3 cubic feet of gravel or stone.

A mixture of 1:2:3 gives a very dense, strong, and waterproof concrete. It is, therefore, suitable for cisterns and tanks, and for work subjected to unusual stress, wear, or moisture exposure.

A 1:2:4 mixture produces concrete of quite high strength and waterproofness.

The mixture of 1:2½:4 concrete will be found easy to work and place in the forms, and it does not leave as many rock pockets against the wall as is usual with a mixture which contains less sand. Its strength will be found very nearly that of a 1:2:4 mix, and for sidewalks and similar work it will finish nicely without the addition of any mortar or granolithic surfacing. In this way a rough, gritty surface is obtained with a minimum of labor and material.

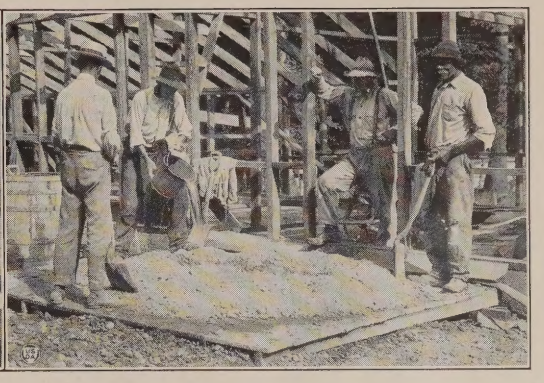
A mix of 1:2½:5 is suitable for footings and walls thicker than 6 inches. Any mix in which the cement proportion is lower than this can be used only where mass and not strength or watertightness is required.

VOLUME OF CONCRETE FROM VARIOUS MIXTURES MADE IN BATCHES, EACH CONTAINING ONE SACK OF CEMENT

Mix	Cement	Sand	Pebbles or Stone	Volume of Concrete
Cement, sand, and pebbles in order given	Sacks	Cubic feet	Cubic feet	Cubic feet
1 : 1½ : 3	1	1½	3	3½
1 : 2 : 3	1	2	3	4
1 : 2½ : 3	1	2½	3	4¼
1 : 2 : 4	1	2	4	4½
1 : 2½ : 4	1	2½	4	4⅘
1 : 2½ : 5	1	2½	5	5⅘
1 : 3 : 6	1	3	6	6½

TABLE OF CONCRETE MIXTURES

	Mixture	Maximum Size Aggregate
Barnyard pavements	1:2½:4	1½″
Building walls above foundation, when stucco finish will not be applied	1:2½:4	1½″
Concrete floors	1:2½:4	1½″
Concrete roads and pavements	1:2:4	2½″
Concrete steps	1:2:4	1″
Construction subjected to water pressure, such as reservoirs, tanks, and cisterns	1:2:3	1″
Corn-crib floors	1:2½:4	1½″
Culverts, dams, small retaining walls	1:2:4	2″
Dairy barn floor	1:2½:4	1½″
Dipping vats	1:2:3	1½″
Feeding floors	1:2½:4	1½″
Fence posts	1:2:3	½″
Foundations for engines subjected to heavy loading, impact, and vibration	1:2:4	2″
Foundations for small engines	1:2½:5	2″
Grain-bins, elevators, and similar structures	1:2½:4	1½″
Hog-house floors and foundations	1:2½:4	1½″
Hog wallows	1:2:3½	1″
Hotbeds and cold frames	1:2½:4	1″
Manure pits	1:2½:4	1½″
Manure pit floors and walls	1:2½:5	1½″
Mass concrete—large retaining walls, heavy foundations, and footings	1:3:6	3″
Mass foundations	1:2½:5	3″
Milk-house floors	1:2½:4	1½″
Milk-house walls	1:2½:4	1½″
Pavements	1:2½:4	1½″
Poultry house floors and foundations	1:2:3½	1″
Reinforced concrete roof slabs	1:2:3	1″
Reinforced concrete walls, floors, beams, columns, and other concrete members designed in combination with steel reinforcing	1:2:4	1″
Septic tanks	1:2:4	1″
Sidewalks	1:2½:4	1½″
Silos	1:2:3	1½″
Smokehouses	1:2:4	1″
Stable and barn floors	1:2½:4	1½″
Steps and stairways	1:2½:4	1″
Walls above ground	1:2:4	1½″
Walls of pits or basements exposed to moisture	1:2:3	1½″
Watering troughs and tanks	1:2:3	1″
Watertight walls	1:2:3	1½″
Well covers, reinforced	1:2:4	¾″
Well linings	1:2:3	1″



Mixing Concrete

IF concrete is to be mixed by hand, a watertight mixing platform is needed, about 8 by 10 feet, large enough for two men to work upon at one time. It can be made of 1- or 1¼-inch surfaced lumber, tongued and grooved, and free from knots. Tight joints are necessary to prevent the loss of cement when water is added. A strip around the edge about 2 inches high will prevent loss of materials.

An ordinary water bucket of 12-quart capacity provides a convenient means of measuring quantities, or a measuring box 12 by 12 by 12 inches (inside measurements), without a bottom, will hold one cubic foot. If the box is used, the cement need not be measured, as each sack contains one cubic foot.

Measure sufficient sand for one batch and spread over the board to a depth of 3 or 4 inches. Then spread the cement as evenly as possible over the sand, and turn over both cement and sand with a shovel until all streaks of brown and gray disappear and the color is uniform. Measure the desired quantity of pebbles or broken stone and spread in a layer on top of the cement and sand. Mix all the materials thoroughly by turning several times with a shovel. Make a hollow in the center of the pile and add water while mixing until the desired consistency is obtained.

Avoid using too much water in mixing. Excess water weakens concrete. The concrete should always be wet enough to bring water to the surface with moderate spading.

A moderately wet mix, just wet enough to run off a shovel or pour from a wheelbarrow or bucket, is best for pouring into forms and for reinforced concrete work in which the steel must be perfectly embedded.

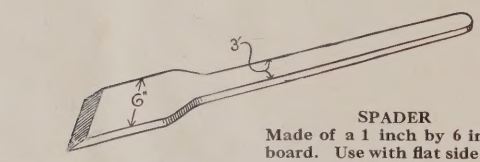
A quaking or jelly-like mix (one that trembles when spaded) is required for floors, driveways, and pavements. The quaky mix is preferable wherever it can be used.

Thorough mixing increases the strength of concrete, and a small power-operated mixer will reduce labor cost and give better concrete.

Placing Concrete

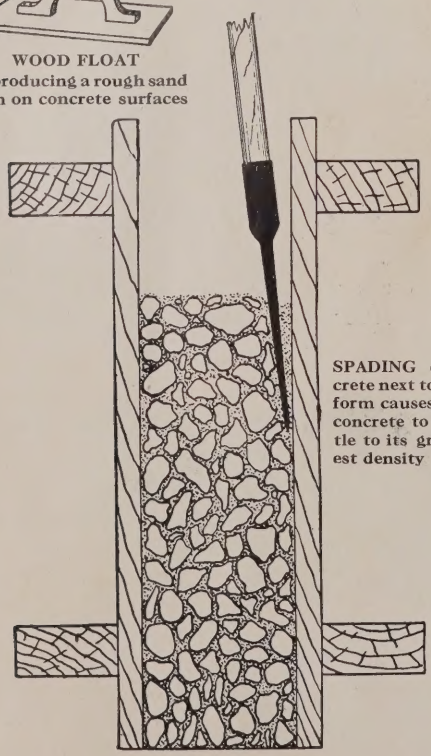
CONCRETE commences to harden very shortly after the water is added, and should be placed in the forms as soon after mixing as possible, in order that it may assume the shape intended. It is convenient to have the mixing operation carried on near the place where the concrete is to be deposited.

When concrete is being placed in an excavation for a foundation wall, place boards or planks along and across the trench so that workmen wheeling barrows loaded with concrete can dump the concrete without breaking down the trench sides. Concrete should be deposited in layers of uniform thickness throughout the enclosure made by the forms. From 6 to 8 inches is the greatest depth that should be placed at one time, because a layer of greater thickness cannot be compacted by spading or tamping.



SPADER
Made of a 1 inch by 6 inch board. Use with flat side toward the form

WOOD FLOAT
For producing a rough sand finish on concrete surfaces



SPADING concrete next to the form causes the concrete to settle to its greatest density

Concrete placed in forms should be consolidated by spading, but spading against the form itself brings to the outside of the wall a skin coat of a very rich mixture which will shortly develop hair cracks. These mar the appearance of the structure and are by no means easily eliminated. The proper method to insure satisfactory tamping and provide a surface free from rock pockets and air holes is to spade lightly an inch or so away from the wall surface. This will cause the concrete to settle into place with no appreciable amount of disturbance.

When concreting troughs, watering tanks, silos, and other structures which should be both air- and water-tight, concreting should be carried on as continuously as possible in order to eliminate construction seams. Many jobs cannot be completed within a working day. Work stopped for the day must be left in such condition as to make it easy to resume later without leaving a poor bond or the effect of a seam. This is usually done by roughening the concrete in the form when work is stopped, then immediately before resuming work painting the old surface with a paint made of cement and water, mixed like thick cream, and applied with a broom or swab. Immediately following this, place the concrete in the regular way.

Between narrow forms concrete has to be placed in thin layers because of the difficulty of spading in the narrow space. Under such conditions only one side of the form should be boarded up to full height, leaving the other side to be boarded as concreting progresses.

For all work where a non-slip surface is desired, such as walks, steps, and floors, the concrete should be finished with a wood float, which will give a slightly rough finish. This is particularly advisable in a stable or dairy barn, as the floors are often wet.

Water tanks, milk cooling tanks and similar work are more sanitary when finished with a steel trowel. The smooth, hard finish is also more impervious to water.

Curing Concrete

THE hardening of concrete is not a drying process. It is the combination of water with cement which causes concrete to harden. Forms are often taken down and the work exposed to wind and sun in the belief that such treatment is an aid to thorough hardening. This practice deprives the concrete of a great deal of added strength that proper protection would have given it. Exposure to drying influences weakens concrete structurally and deprives concrete floors, walks, and other work of strength that would increase wear resistance. Keeping concrete damp the first ten days will give 65 per cent. increased strength and hardness. Three weeks' protection will give a still greater increase.

The forms furnish a measure of protection to concrete walls above ground. The earth of a foundation trench in contact with the concrete provides all the protection the foundation needs while curing. Work above ground, however, should be wet down for several days by drenching it with water, in order thoroughly to harden the concrete. Floors, sidewalks, street and road pavements are protected by a layer of moist earth, sawdust, or other moisture-retaining material applied as soon as it can be placed without marring the surface of the concrete. The best method of protecting pavements and other flat surfaces is to place a small ridge of clay around the edge and flood with water.

Walls can be covered with canvas or burlap and sprinkled with water several times a day.

During moderate weather, where floors are being laid indoors, the enclosure formed by the structure makes extreme measures of curing unnecessary. However, occasional sprinkling of the concrete surface for several days will increase its strength.

Curing is well repaid in the greater strength, durability, and wearing resistance of the concrete, particularly in the case of driveways, walks, and other work subjected to heavy travel.

Waterproofing Concrete

CONCRETE that is correctly proportioned, thoroughly mixed, properly placed, and well protected while curing will be watertight.

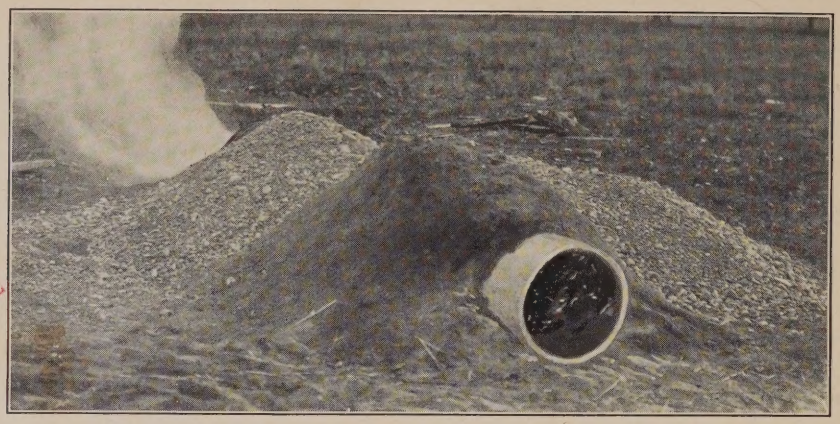
Hydrated lime is often used in the mixture as a waterproofing agent, in proportion of one-tenth part of lime to one of cement. It also is useful in increasing the workability of the mix.

Asphalt and coal-tar are sometimes used for waterproofing, particularly as applied to the outside of foundation or basement walls. They are applied hot with a mop. Several coats are usually given.

Failure to make some classes of construction waterproof can be remedied by various after-treatments. If leakage from a cistern or tank consists merely of slight seepage through the walls, a coat of cement mortar (sand and cement) may be applied to the interior of the tank. The surface must be thoroughly cleansed by scrubbing it with water and a good stiff wire-brush. If scrubbing will not clean the surface, then the cement film should be removed by applying a wash of one part muriatic acid to three or four parts of water, allowing this to remain for but a very few moments and then *thoroughly* rinsing with clean water. Immediately before applying the plaster coat the cleansed surface should be painted with cement and water mixed to the consistency of cream. This can be applied with an ordinary brush and the plaster should be spread on immediately and worked in place vigorously before this wash has commenced to harden.

Plastering will not remedy cracking due to deficient and ineffective reinforcement. The only way to repair such a structure is to use the old tank as a form and build a new reinforced concrete lining within it.

Cracks in tanks or troughs can be repaired by cutting out each side of the crack to form a "V"-shaped groove 1½ inches deep and about 1 inch wide at the surface. Calk this groove with oakum soaked in tar until half filled, and finish with a 1:2 cement mortar (one part of cement and two parts of sand).



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Summer and Winter Concrete Work

HEAT hastens the hardening of concrete and cold retards it. Sufficient protection must be given to concrete placed during extremes of temperature to permit it to obtain its maximum strength through proper curing.

In Cold Weather

When the prevailing temperature is in the neighborhood of 38° F., the hardening of concrete is practically suspended. At 32° F. (the freezing point) it ceases entirely.

There is no change in the mixture or methods of placing concrete in winter. The difference lies in the preparation of the materials, such as heating the water, sand, and stone and in protecting the work until the concrete has hardened. Sand, pebbles, or broken stone are readily heated by stoves improvised from sections of an old steel smokestack, and water may be heated in any convenient receptacle.

The following points should be observed:

Forms should be free from ice and snow before concrete is placed.

All the materials, except the cement, should be heated, and the temperature of the concrete after mixing should not be lower than 80° F.

Concrete should be placed in the forms as quickly as possible.

All work on the job should be speeded up.

Immediately after placing, steps must be taken to provide proper protection against actual freezing of the concrete.

Various methods are used to protect the concrete and to keep it nearly at 60° F. for at least two days. At the end of this time hardening will have progressed far enough to render it proof against injury from freezing.

Frozen concrete should not be mistaken for naturally hardened concrete. Forms should not be removed from concrete work done in cold weather until it is positively known that the concrete will be self-supporting, or if it is to carry loads other than its own weight, that it has acquired sufficient strength.

Coke-burning stoves will maintain the required temperature. Where the work is not enclosed, canvas or building paper fastened to frames will provide the necessary housing.

In Warm Weather

Protection should be given to concrete placed during hot, dry weather, to prevent the concrete from drying too quickly.

Floors, walks, and pavements can be protected by immediately stretching canvas on frames over the concrete. Then, when the concrete has hardened enough so it will not be marked or pitted by covering with earth or other water-retaining material, two inches of this should be evenly spread over the surface. This covering should be sprinkled often enough each day to keep it moist.

Walls of such structures as concrete silos and water tanks should be protected either by frequent sprinkling or preferably by hanging canvas or burlap over them. The covering as well as the concrete should be sprinkled often. When temperatures are not extremely high, sprinkling of the concrete alone gives the desired protection.

Gravel 117-129 lbs. To Cub.
Sand 95-105 " " "

1 · 2 - 4
1 - 2½ - 5

$$5\overline{)15}\quad 13\quad \frac{5}{15}$$

$$3\overline{)200}\quad 20,\ 10,\ 18,\ 20,\ 18$$

$$11\quad 9,\ 19,\ 9,\ 171$$

$$200 \times 3 = 600$$

$$70 \times 10 = 700 \qquad 14$$

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